SANDAKANIA 20 (2015): 165–204

Begonia (Begoniaceae) from Tawau Hills Park, Sabah, Malaysia, including Ten New Species

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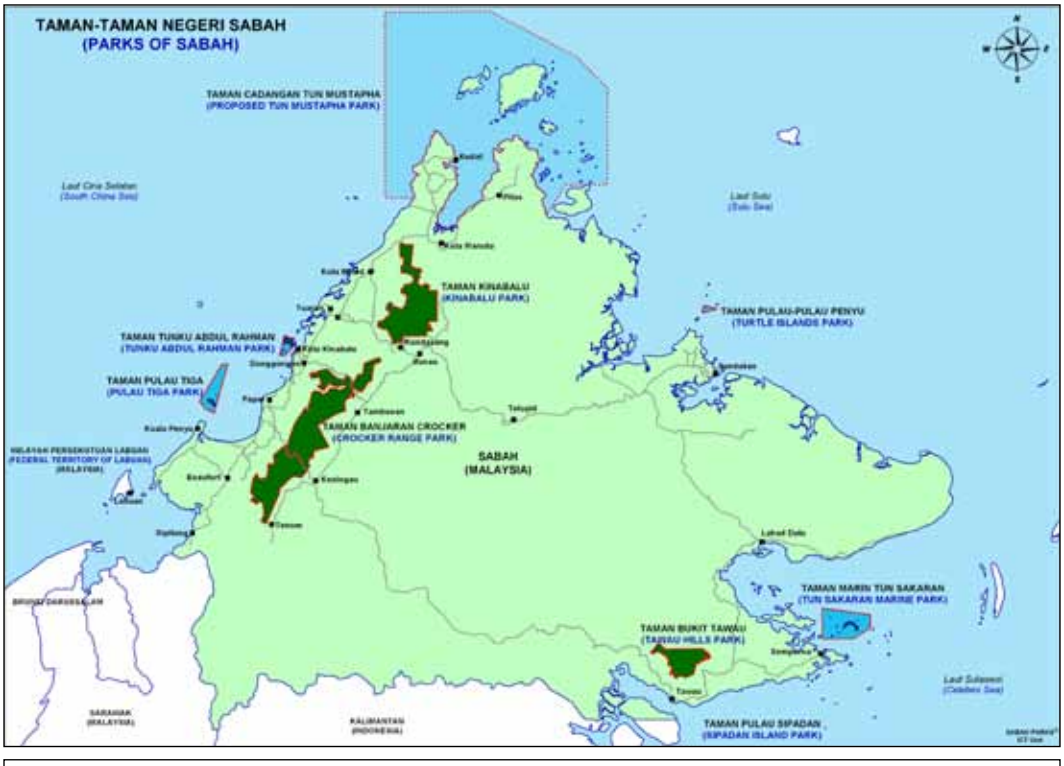
Summary. There are 13 *Begonia* species found in Tawau Hills Park, Sabah, Malaysia, of which ten species are new: *B. basintaliana* Rimi, *B. gelasensis* Rimi & Kinahim, *B. gusilii* Rimi, *B. lamriana* Rimi, *B. mariaensis* Rimi & Simun, *B. jamiliana* Rimi, *B. paracauliflora* Rimi, C.-I. Peng & S.M. Ku, *B. renek* Rimi, *B. simunii* Rimi and *B. tindan* Rimi & Kinahim. All ten species are endemic to Tawau Hills Park. Three widespread species, namely *B. fuscisetosa* Sands, *B. gomantongensis* Kiew and *B. postarii* Kiew, were also recorded. Twelve species belong to section *Petermannia* and only one, *B. simunii*, belongs to section *Baryandra*. A key to species and descriptions of new species are provided.

The Tawau Hills Park (THP), covering an area of 27,984 ha, is located in the east coast of Sabah (*ca*. 4° 27' N, 117° 57 E) (Fig. 1). The Park was gazetted in 1979 under the Sabah Parks Enactment, mainly to protect water catchment and to preserve the flora and fauna. The Park covers hilly terrain from 30 m to 1310 m elevation with three peaks, namely Mt. Magdalena (1310 m), Mt. Lucia (1189 m) and Mt. Maria (1067 m). Geologically, the area is comprised of alluvial volcanic soil with some patches of *kerangas*.

Most areas in Tawau Hills Park with pristine vegetation have not been fully explored. Historically, about 40% of the area had been logged long before it was gazetted as a State Park in 1979. Based on reports from a series of studies, the remaining forests represent an invaluable natural resource of flora and fauna. The predominant vegetation type consists



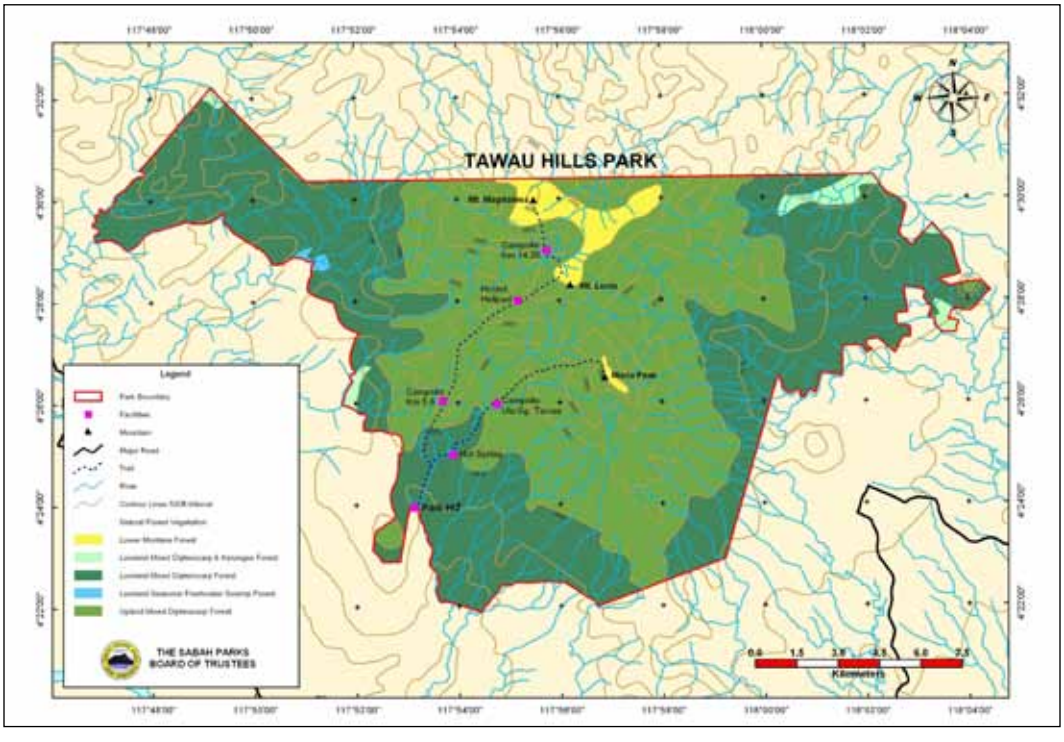


Fig. 1 (above). Locality of Tawau Hills Park within Sabah. **Fig. 2** (below). Study area. The main trails to Mt. Lucia, Mt. Magdalena and Mt. Maria.

of mixed dipterocarp forest luxuriant in many commercial timber species, including 62 species of Dipterocarpaceae (Rimi *et al*., 2008) as well as a high diversity of non-woody plants such as 64 species of Zingiberaceae (Gobilik & Limbawang, 2010), 150 species of Orchidaceae (Lim, 1995) and 27 species of Araceae (Rimi & Yabainus, 2008). Seino *et al*. (2007) demonstrated the significant difference in floristic composition and stand structure in the Tawau Hills Park due to soil nutrient richness from accumulation of volcanic ash.

Materials and Methods

The *Begonia* study was started in 2005 under the 'Plants of Forest Floor Documentation Project'. This project aims to document plants of ornamental interest to be planted at an *ex-situ* garden in Tawau Hills Park. The study area covered only a small patch of Tawau Hills Park mainly around the Headquarters and along the trails to the summits of Mt. Magdalena, Mt. Lucia and Mt. Maria (Fig. 2). Most collections were made during a series of fieldwork since 2005 and also included collections made in 2013 during the Balung sub-station flora and fauna exploration program. Conservation assessments follow standard IUCN procedures (IUCN, 2001).

Taxonomy Treatment

Thirteen begonia species were recorded from Tawau Hills Park, including ten new species described below. Twelve species belong to section *Petermannia* and one belongs to section *Baryandra*.

KEY TO SPECIES OF *BEGONIA* IN TAWAU HILLS PARK

1. Rhizomatous begonia. Stems *c*. 6.5–9 cm long, *c*. 1.8 cm thick, succulent, internodes short ..... 12. *B. simunii*
   Erect or cane-like begonia 2

2. Stems branched with 2 or more branches 3
   Stems rarely branched 9

3. Leaves oblique (midrib at an angle to the petiole) 4
   Leaves not oblique (petiole in line with the midrib) 12

4. Low herbs, less than 40 cm tall. Leaves brownish or blackish-green ..... 7. *B. lamriana*
   Herbs, more than 40 cm tall. Leaves green 5

5. Stems, lamina, inflorescence densely pubescence ..... 10. *B. postarii*
   Stems, lamina, inflorescence glabrous to partly hairy 6

6. Inflorescence peduncle hanging down, more or less horizontal 7
Inflorescence peduncle erect 8

7. Inflorescence up to 30 cm long; male and female flower on the same inflorescence ..... 8. *B. mariaensis*
Inflorescence up to 7 cm long; male and female from different leaf axils ..... 11. *B. renek*

8 Bract persistent, enveloping clusters of male flower. Capsules hairy ..... 4. *B. gomantongensis*
Bract caducous. Capsules with scattered fine hairs ..... 3. *B. gelasensis*

9 Stems pubescent to hispid. Upper lamina surface with a row of bristly hairs between the veins 10
Stems with appressed hairs. Lamina glabrous 11

10 Fruits with 6 wings, 3 fully developed, 3 smaller and protruding from junctions of carpels ..... 9. *B. paracauliflora*
Fruits with 3 short or more or less undeveloped wings ..... 5. *B. gusilii*

11 Male flowers with 4 tepals, in a simple cyme of 1 to 2 flowers ..... 6. *B. jamiliana*
Male flowers with 2 tepals, in a row of overlapping bracts ..... 13. *B. tindan*

12 Leaves lanceolate, 4–8 cm wide and 11.5–22 cm long, apex acuminate ..... 1. *B. basintaliana*
Leaves oblanceolate, 1.5 cm wide and 4.5–10 cm long, apex sharply acute ..... 2. *B. fuscisetosa*

Species Descriptions

1. Begonia basintaliana Rimi **sp. nov.** (Section *Petermannia*)

It is similar to *Begonia danumensis* F.Y. Chong (2015) in its subopposite leaves and lamina shape, size and venation, but it is different in having glabrous lamina in *B. basintaliana* (vs. hairy as in *B. danumensis*), the lamina has fewer veins, 2–4 on each side of the midrib (vs. *c.* 7), a longer inflorescence 7 cm long (vs. 4.5–5.5 cm long and much longer fruit stalks 12–15 mm long (vs. 4–8 mm long). Type: *Masrina et al. SP 10518*, Borneo, Sabah, Tawau District, Tawau Hills Park, Trail to Bukit Bombalai, 2 March 2005 (holotype SNP!; isotype SAN!). (**Fig. 3**)

Cane-like begonia, 30–60 cm tall, glabrous. Stems red, *c.* 4–6 mm thick, internodes *c.* 4–7 cm long, glabrous, branches, slightly swollen at nodes. Stipules pale green, glabrous,

broadly lanceolate, *c*. 15–244 × 5–10 mm long, keeled, margin entire, apex acuminate, acumen *c*. 2 mm long, persistent. Leaves more or less opposite, not oblique, distant, held horizontally; petiole red, glabrous, *c*. 0.5–1.5 cm long, grooved above; lamina plain green above, light green beneath, glabrous, fleshy in life and papery when dried, glossy, lanceolate, asymmetric, 11.5–22 × 4–8 cm long, broad side 2–4.5 cm, base acuminate, basal lobes 0.5–0.8 cm wide, broadly rounded, margin slightly serrate, apex acuminate, acumen 1.5 cm long; main veins green and red near the base, glabrous, venation palmate-pinnate, 2–4 veins on either side of the midrib, 2 veins in basal lobe, impressed above, prominent beneath. Inflorescences protogynous, terminal on lateral branches, glabrous; female inflorescences

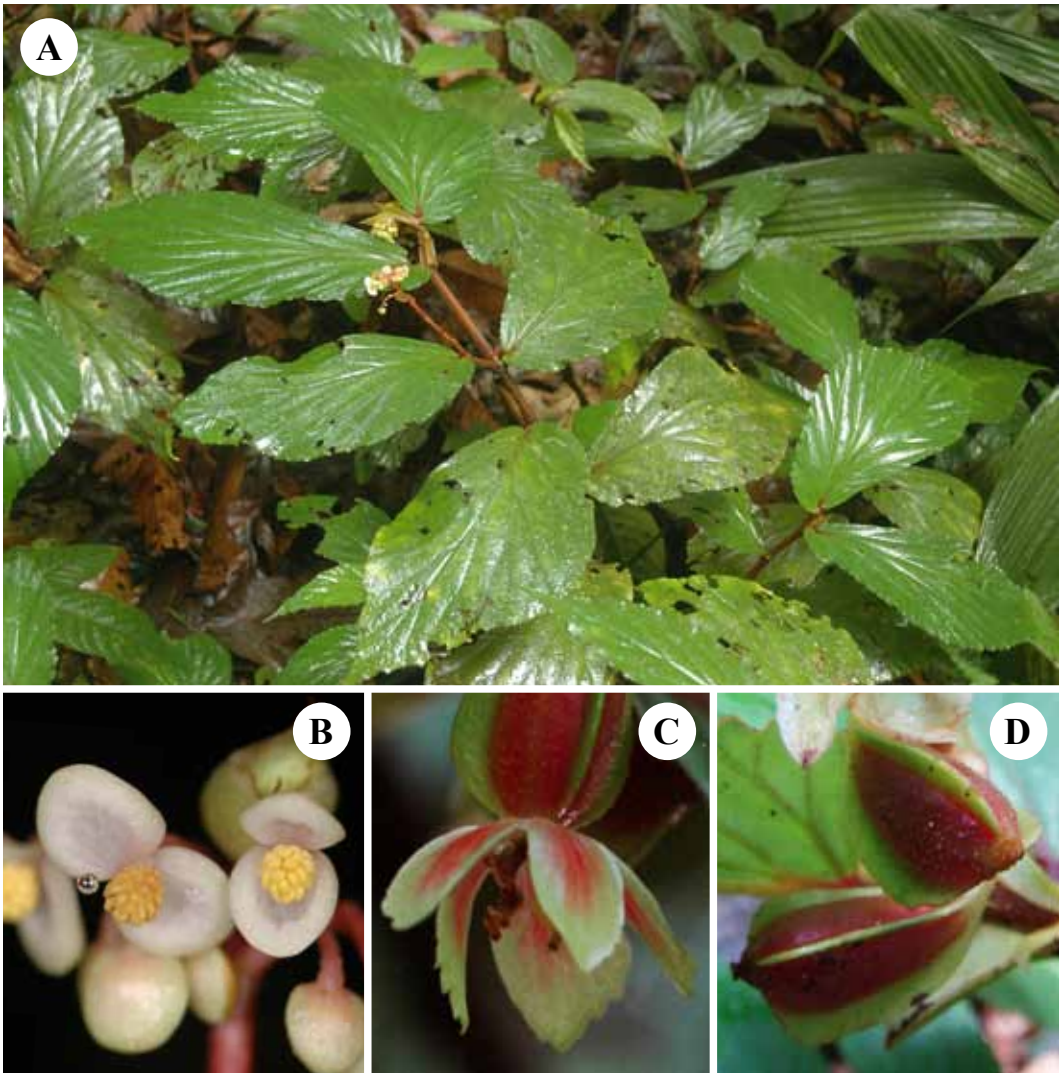


Fig. 3. *Begonia basintaliana*. **A.** Habit with woody stem and flower; **B.** Close-up of male flower; **C.** Side view of female flower; **D.** Fruit. All photos by Ramlan Miadin.

with one or rarely two flowers at the base; male inflorescences 7 cm long with a few short cymose branches, peduncle 0.4 cm long, reddish. Bracts pale green, lanceolate, 12 × 4 mm, keeled, margin entire, persistent. Bracteoles pale greenish, lanceolate to broadly ovate, *c*. 6–8 × 4 mm, glabrous, persistent. Male flower: pedicel reddish, 4 mm long; tepals 2, white tinged greenish, sometimes reddish in the middle, glabrous, ovoid, *c*. 5–8 × 3–5 mm, margin entire, apex rounded; stamens *c*. 22, cluster conical, subsessile; filaments pale yellow, *c*. 1.5–2.2 mm long; anthers yellow, obovate, *c*. 0.7 × 0.2 mm, apex with short peak in the middle. Female flower: pedicel 12–15 mm long, greenish; ovary green or red, finely hairy, spindle-shaped, *c*. 15 × 5 mm, wings 3, equal, locules 3, placentas 2 per locule with many ovules on both surfaces; tepals 5, isomorphic, 6–8 × 4–7 mm broadly lanceolate to ovate, white-greenish sometimes reddish in the middle, margin serrate, apex slightly acuminate; styles 3, deep yellow, *c*. 3 mm long, divided to base, deeply Y-shaped with twisted tips; stigma yellow, papillose forming a continuous twisted band. Capsule pendent, *c*. 1.5–2.2 × 0.8–1.5 cm, short hairy in life, glabrous when dry, locules broadly spindle-shaped, wings 3, equal, narrowed proximally, *c*. 2 × 2–4 mm, fibrous, dehiscing between the locule and wing; pedicel *c*. 1.2–1.5 cm long. Seeds: barrel-shaped, *c*. 0.7–0.8 mm × 0.3 mm, columnar cells less than half the length of seed.

ETYMOLOGY. Named in honour of Paul Basintal, the former Director of Sabah Parks, who retired in 2014.

ECOLOGY. Primary forest, under forest canopy, 100–800 m elevation.

DISTRIBUTION. Borneo. Endemic to Sabah (Tawau Hills Park).

CONSERVATION STATUS. Least Concern. It is found in Tawau Hills Park, which is a totally protected area.

SPECIMENS EXAMINED—BORNEO. SABAH: Tawau District: Tawau Hills Park Lowland Garden, *Simun et al. KNP A 14706* (SNP, SAN); *Shahida et al. BORH 0624* (BORH, SNP); Trail to Bukit Bombalai, *Masrina et al. SP 10518* (holotype SNP!; isotype SAN!).

NOTES. The fruits vary in colour from reddish pink to greenish.

2. Begonia fuscisetosa Sands (1997: 433). (Section *Petermannia*). Type: *M.J.S. Sands 5606 et al.*, Brunei Darussalam, Temburung District, Subd. Amo, by the Temburung River *c*. 0.5 km upstream from Kuala Belalong, 25 March 1991 (holotype K, isotype BRUN!).

Erect begonia, shrubby, 50 cm tall. Stems reddish green, branched, slightly thicker at nodes on the lower stem, succulent, grooved when dried, internodes 1.5–4 cm long, 2–4 cm thick, becoming woody at base, sparsely hairy, hairs translucent, 1–1.5 mm long. Stipules keeled,

pale green, persistent above, margin entire, glabrous, lanceolate, *c*. 1.2–2 cm long, apex setose, seta 1 mm long. Leaves alternate, distant, held horizontally; petiole reddish-green, terete, 0.3–0.7 cm long, with sparsely translucent hairs; lamina oblanceolate, green, matt, slightly fleshy in life, becoming papery when dry, spotted red-brown with a bristle in between main veins, slightly asymmetric, 4.5–10.5 × 1.5–3.5 cm, broad side 1–2 cm, base acute, basal lobe 0.5–1 cm, margin doubly serrate, tip sharply acute; venation palmate-pinnate, 3–5 pairs of veins, 1 pair in basal lobe, branching halfway to margin, impressed above, concolorous, beneath impressed, green. Inflorescences protogynous, terminal on lateral branches, glabrous, 2–7.5 cm long, cymose branches short, peduncle pale greem, 1.5–4 cm long; female inflorescence: a reduced cyme with one flower; male inflorescence: peduncle 1.5–4 cm with a few cymose branches. Bracts on male flower, narrowly triangular, pale green, *c*. 0.5 × 0.3 mm, margin entire, persistent. Male flowers many, pedicel light green, *c*. 0.2–0.5 cm long; tepals 2, white, margin entire, oval to rounded, tip rounded, glabrous; stamens 12, in a loose cluster, globose, 2 × 1.8 cm across, stalked *c*. 0.5 mm; filaments *c*. 0.5 mm long, anthers yellow, narrowly obovate, 0.8 × 0.6 mm, apex emarginate. Female flowers: ovary, 1–1.5 × 0.8 cm, pale green, locules 3, placentas 2 per locule, wings 3; tepals 5, white, lanceolate, apex rounded; styles 3, yellow, 3 mm, divided to base, yellow; stigma papillose forming a continuous twisted band. Capsule 8–9 × 5–6.5 cm, wings equal, 1–1.5 × 2–3 cm, dehiscing between locule and wing; pedicel 1–13 cm long. Seeds barrel-shaped, *c*. 0.5 mm long, collar cells slightly more than half the seeds length.

ETYMOLOGY. Latin, *fusci-* dark brown; *setosus* = bristly, referring to the characteristic row of bristles between the veins on the upper leaf surface.

ECOLOGY. It grows on the forest floor, under the shade of canopy trees.

DISTRIBUTION. Endemic to Borneo. Widespread throughout Sabah, Brunei Darussalam and Sarawak. In Tawau Hills, it was collected on the trail (800 m) to Mt. Magdalena. It was also found at the Sayap sub-station (950 m) and on the Liwagu trails (1500 m) in the Kinabalu Park.

CONSERVATION STATUS. Least Concern. Widespread and it is also found in Tawau Hills Park, which is a totally protected area.

SPECIMENS EXAMINED—BORNEO. SABAH: Tawau District: Tawau Hills Park — Trail to Mt. Magdalena, *Duni et al. KNP 14104* (SNP), Lowland Garden, *Rimi, SNP A 16606* (SNP, SAN). **BRUNEI DARUSSALAM:** Temburung District, Subd. Amo, by the Temburung River *c*. 0.5 km upstream from Kuala Belalong, *M.J.S. Sands 5606 et al.* (holotype K, isotype BRUN!).

NOTES. It is a shrubby small herb characterized by stiff red bristles with small red bases in between the veins on the upper leaf surface.

3. Begonia gelasensis Rimi & Kinahim **sp. nov.** (Section *Petermannia*)

It is similar to *Begonia inostegia* Stapf (1894: 166) in its habit and broad leaves with radiating parallel venation, but it is different in having fewer veins that are more distantly spaced (vs. many, close or compact veins as *B. inostegia*), larger male flowers with tepals *c.* 10 × 6 mm (vs. 4–6 × 3–4 mm), and sparsely branched inflorescences (vs. with tiers of much-branched side branches, and many male flowers as in the case of *B. inostegia*). Type: *Rimi R. SNP A16601*, Borneo, Sabah, Tawau District, Tawau Hills Park, Gelas Waterfall area, 18 December 2009 (holotype SNP!; isotype SAN!). (**Figs. 4 & 5**)

Erect, bushy herb to *c.* 40–60 cm tall. Stems glabrous, much branched, rooting at nodes, internodes 5–10 cm long, slightly swollen, 6–8 mm diameter, hollow and grooved when dry. Stipules pale green, narrowly lanceolate to triangular, *c.* 6 × 5 mm, margin entire, apex acuminate, acumen *c.* 0.5 mm, caducous. Leaves alternate, distant, slightly horizontal; petiole red brown or purple, *c.* 3–6.5 cm long; lamina plain green above, paler beneath, slightly fleshy in life and papery when dry, glossy, ovate, asymmetric, *c.* 10–18 × 6.5–9 cm, broad side 3.5–5.5 cm, base cordate, basal lobes 3 cm, rounded, margin entire to finely serrate, acute; venation dark red, palmate-pinnate, 3–4 pairs on both sides, basal lobes 2 pairs, branching halfway towards the margin, impressed half way towards the margin of upper surface, prominent beneath. Inflorescences protogynous, terminal on lateral branches, glabrous, *c.* 4–6 cm, racemose; male inflorescences, erect, *c.* 4–8 cm long with 3–5 cymose branches, rachis 4–6 mm long; peduncle *c.* 1–1.5 cm long, brownish red. Bracts not seen. Male flower: pedicel pale yellow, 1–3 mm long; tepals 2, white, glabrous, oval, *c.* 10 × 6 mm, margin entire, apex acute; stamens *c.* 39, cluster conical, *c.* 5 mm × 3 mm, subsessile; filaments yellow, *c.* 0.2 mm long; anthers deep yellow, oblong, *c.* 2 × 1 mm, apex emarginate. Female flower: pedicel 8 mm long, brownish red; ovary white tinged greenish, finely hairy, oblong, *c.* 1.5 × 0.4 cm, wings 3, equal, locules 3, placentas 2 per locule with many ovules on both surfaces; tepals 5, isomorphic, *c.* 10 × 5 mm, broadly lanceolate, white, margin entire, apex acute to obtuse; styles 3, deep yellow, *c.* 4 mm long, divided to base, Y-shaped; stigma yellow, papillose forming a twisted band. Capsule reflexed, *c.* 1.4–2 × 1–1.8 cm, glabrous, locules 3, wings 3, equal, narrowed proximally, *c.* 6 mm wide, thinly fibrous, dehiscing between the locule and wing; pedicel *c.* 8 mm long. Seeds barrel-shaped, *c.* 0.5 × 0.2 mm, columnar cells more than half the length of seed; pedicel *c.* 8 mm long.

ETYMOLOGY. The species named for the Gelas Waterfall, from where the first collection was made.

ECOLOGY. Lowland to lower montane forest at 200–830 m elevation in shady areas.

DISTRIBUTION. Borneo. Endemic to Sabah (Tawau Hills Park).

CONSERVATION STATUS. Least Concern. It is found in Tawau Hills Park, which is a totally protected area.

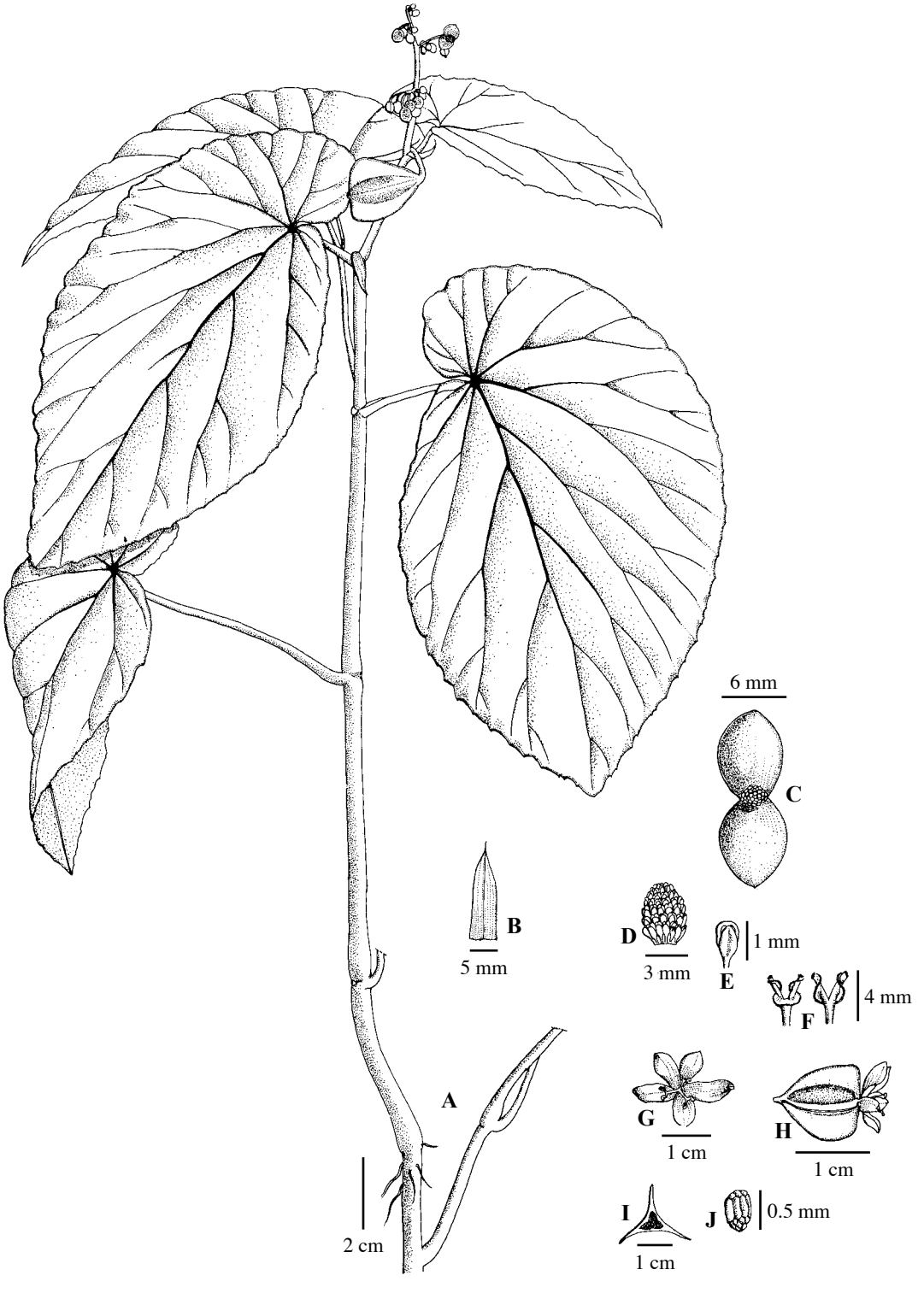


Fig. 4. *Begonia gelasensis*. **A.** The plant; **B.** Stipule; **C.** Male flower; **D.** Stamen cluster; **E.** Stamen; **F.** Styles and stigmas; **G.** Female flower; **H.** Fruit; **I.** Cross-section of ovary; **J.** Seed.

SPECIMENS EXAMINED—BORNEO. SABAH: Tawau District: Tawau Hills Park — Waterfall Bukit Gelas, *Rahimah et al. SP 18057* (SNP), *Rimi R. SNP A16601* (holotype SNP!; isotype SAN!); Bukit Gelas Waterfall area, *Masrina et al. SP 10514* (SNP), *Shahida & Siti Farhana No. 0628* (SNP); Balung Hot Spring area, *Dolois et al. SP 17421* (SNP); Lowland Garden, *Simun & Evertius, KNP A 14708* (SNP).

NOTES. This begonia is beautiful and has potential as an ornamental plant.

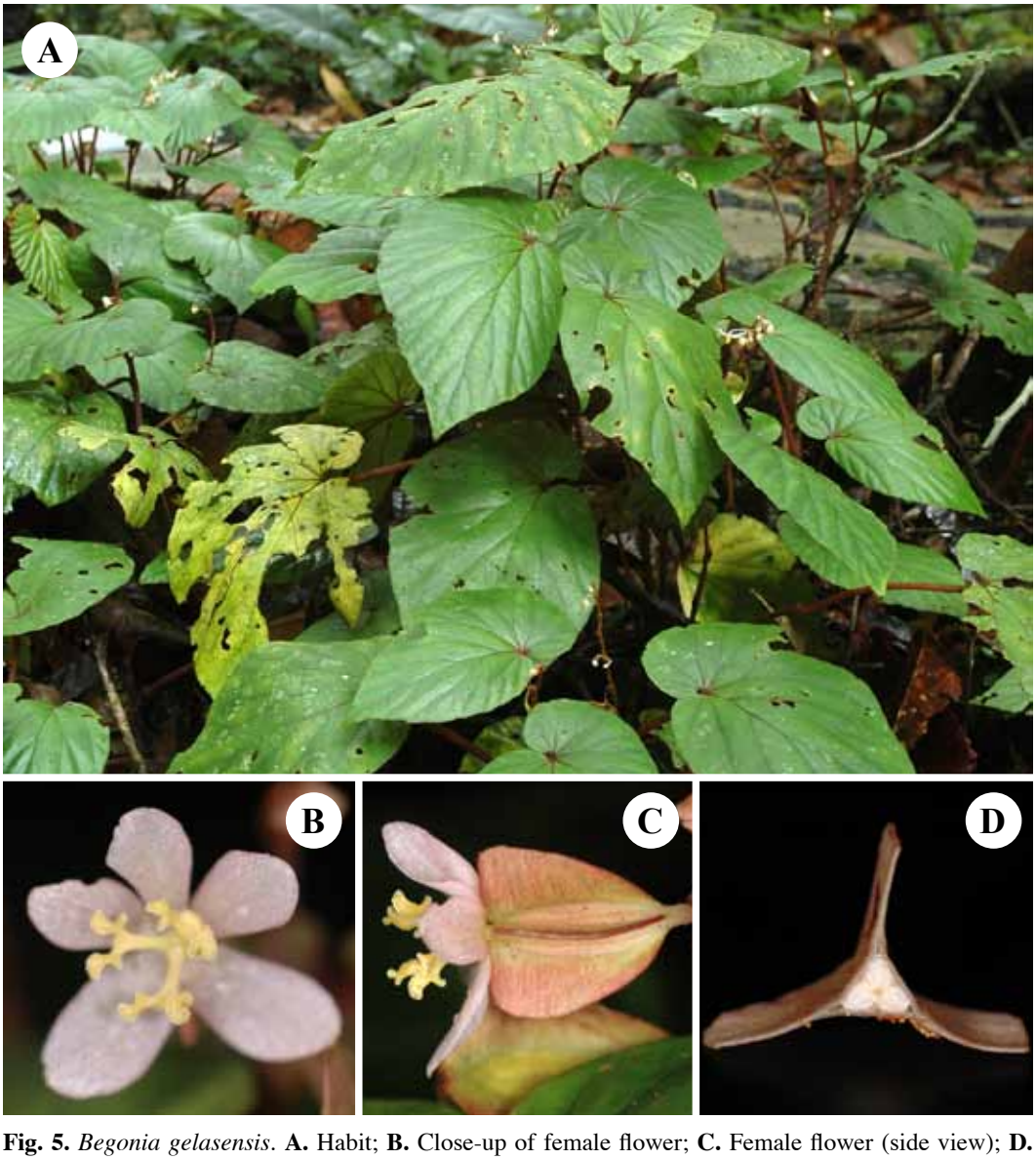


Fig. 5. *Begonia gelasensis*. **A.** Habit; **B.** Close-up of female flower; **C.** Female flower (side view); **D.** Cross-section of fruit (ovary). All photos by Ramlan Miadin.

4. Begonia gomantongensis Kiew (1998: 164). (Section *Petermannia*). Type: *James Awing SAN 47257,* Borneo, Sabah, Kinabatangan District, Gomantong, Bukit Dulong Lambu, 11 October 1964 (holotype SAN!).

Cane-like begonia, erect, to 60 cm tall. Stem sparsely branched, minutely bristly, woody, *c*. 4–5 mm diameter. Lamina oblique, large, 30 × 25 cm, glossy, dark green above, pale green beneath, glabrous, asymmetric, margin minutely serrulate, apex shortly acuminate. Inflorescences protogynous with 1–2 female flowers from the leaf axil and many male flowers on an erect rachis, 2.5–6.5 cm long with short cymose branches *c*. 0.5 cm long. Female flower: tepals 5, white; ovary oblong tapered into pedicel, green tinged pink, *c*. 16 × 11 mm, surface of the locules conspicuously verruculose, wings 3. Male flower: tepals 2, white, rotund, 3.5–4 × 3–3.5 mm; stamens 45, cluster obovoid. Fruits pendent, capsule oblong, 1.7–2.5 × 1.3–1.8 cm, wings 3, equal, broadly rounded proximally, truncate or rounded distally, 4–5 mm wide, stiffly papery, outer surface of locule completely verruculose, dehiscing between the locules and wings.

ETYMOLOGY. Named for the locality from where it was originally collected, Bukit Gomantong being the more familiar name for Bukit Dulong Lambu.

ECOLOGY. In Tawau Hills Park, it grows in deep shade, on wet, volcanic rock boulders on Mt. Maria (over 800 m) and also on trails to Hot Spring (400 m), Balung Sub-Station.

DISTRIBUTION. Borneo. Endemic to Sabah (Lahad Datu, Sandakan and Tawau Districts).

CONSERVATION STATUS. Least Concern. It is found in Tawau Hills Park, which is a totally protected area.

SPECIMENS EXAMINED—BORNEO. SABAH: Tawau District: Tawau Hills Park — *Sukaibin et al. SNP 32904* (SNP); Mt. Maria, Kawah river, *Dolois et al. SNP 36018* (SNP); Balung, route to Hot Spring, *Kinahim & Handry, SNP 25240* (SNP); Kinabatangan, Gua Gomantong, *Rimi et al. KNP 10650* (SNP).

NOTES. This species is distinct in having oblong capsules and distinct pimply surface of the locules.

5. Begonia gusilii Rimi **sp. nov.** (Section *Petermannia*)

It is similar to *B. bruneiana* Sands (1997: 433) in its hispid stems, its more or less symmetric, non-oblique, and narrow slightly obovate leaves, but it is different in its male flowers with 4 large tepals, the outer pair *c*. 14 × 13 mm (vs. with 2 tepals *c*. 7 × 6 mm as in *B. bruneiana*), and its small, almost wingless fruits, *c*. 3.5 × 7 mm (vs. 7–9 × 9–13 mm with 3 wings 3–6

mm wide). Type: *Rimi et al. KNP 12490,* Borneo, Sabah, Tawau District, Tawau Hills Park, Mt. Lucia, waterfall slope near km 10.5, 23 April 2007 (holotype SNP!; isotype SAN!). (**Fig. 6**)

Short herbs, decumbent at the base, rooting at the lower nodes, then erect, 30–40 cm tall. Stems green-reddish, dark brown, 3–4 mm thick, pubescent, hairs red at the base and whitish towards the apex, *c*. 1.5–2 mm long, with one short branched at the base, internodes *c*. 0.5–2 cm long. Stipules pale green to reddish, pubescent, hairs whitish, *c*. 1.5 mm, lanceolate, 11

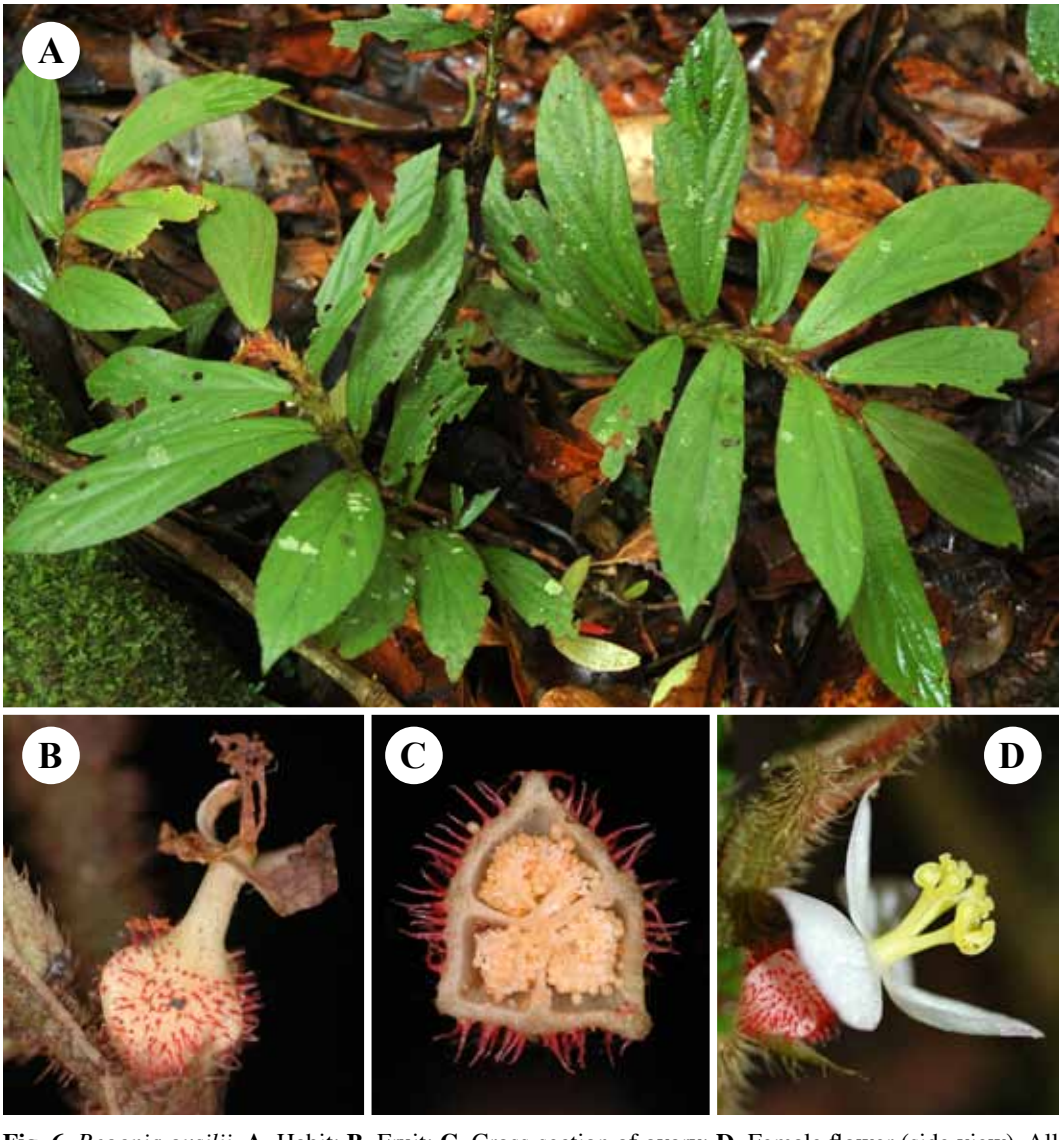


Fig. 6. *Begonia gusilii*. **A.** Habit; **B.** Fruit; **C.** Cross-section of ovary; **D.** Female flower (side view). All photos by Enroe Saudi.

× 6 mm, margin entire with rows of pale brownish hairs below, apex setose, seta *c*. 2 mm long, persistent. Leaves alternate, slightly oblique, distant, held semi-erect to horizontally; petiole green or reddish, pubescent, hairs whitish, 6–8 mm long; lamina plain green, paler below, slightly fleshy in life, matt, with reddish bristles between the veins on upper surface, lanceolate, slightly asymmetric, *c*. 12 × 3.5 cm, broad side 1.3 cm wide, base oblique acute, slightly overlapping, basal lobes 1.5–2 mm, margin entire with fine hairs, apex mucronate; main veins concolorous, bristly on the midrib and veins below, venation pinnate with 3–4 veins on each side of the midrib, 1–2 veins in basal lobe, impressed above, prominent beneath. Inflorescences protogynous, with a single female flower axillary on the lower stem, male inflorescence a simple cyme. Bracts green to reddish, lanceolate, *c*. 2 × 1 mm, margin entire, persistent. Male flower: pedicel white, *c*. 4–5 cm long; tepals 4, glabrous, pure white, outer 2 tepals, broadly ovate or rounded, *c*. 14 × 13 mm, margin entire, apex rounded, inner 2 tepals, narrowly lanceolate, *c*. 13 × 5 mm; stamens yellow, in a loose conical cluster, stalk *c*. 0.5 mm long; filaments yellow, 1–1.2 mm long; anthers yellow, obovate, apex emarginate. Female flower: pedicel *c*. 3 mm long, white, sparsely red hairy; ovary white, with scattered red hairs, broadly ovate, *c*. 7 cm × 3.5 cm, wings not fully developed, locules 3, placentas 2 per locule with many ovules on both surfaces; tepals 5, glabrous, outermost 3 tepals white, slightly rhomboid, *c*. 14 × 10 mm, innermost 2 tepals, white, *c*. 14 × 4 mm, margin entire, apex attenuate to a long point, glabrous; styles 3, persistent, pale yellow, *c*. 5 mm long, divided near the base, Y-shaped with twisted tips; stigma pale yellow, papillose forming a continuous twisted band. Capsule 3.5 × 7 mm, covered with red hair, wings 3, short and not fully developed; pedicel short, 5 mm long. Seeds oblong, *c*. 0.3 × 0.15 mm, columnar cells less than half the length of seed.

ETYMOLOGY. Named after Gusili Johalin, former staff of the Sabah Parks, who managed to climb the precipitous slope of the waterfall, from where it was first collected.

ECOLOGY. Primary forest, lower slope of waterfall, 741 m elevation.

DISTRIBUTION. Borneo. Endemic to Sabah (Tawau Hills Park).

CONSERVATION STATUS. Least Concern. It is found in Tawau Hills Park, which is a totally protected area.

SPECIMENS EXAMINED—BORNEO. SABAH: Tawau District: Tawau Hills Park — Lowland Garden, *Rimi R. SNP A 16603* (SNP); Mt. Lucia, waterfall slope near km 10.5, *Rimi et al. KNP 12490* (holotype SNP!; isotype SAN!).

NOTES. This is a remarkable species with fruits that are covered with red hairs and wings that are hardly developed. Unlike *B. paracauliflora* that has two colour forms (reddish or green beneath), leaves of *B. gusillii* are always plain green. Its stems are usually creeping then erect, which is an adaptation to its habitat. It grows on the slope of a waterfall boulder.

6. Begonia jamiliana Rimi **sp. nov.** (Section *Petermannia*)

In its rarely branched low stems, narrowly obovate and non-oblique leaves with short petioles, laminas that are usually reddish brown beneath, its male flowers in few-flowered simple cymes and solitary female flowers, it is similar to *B. bruneiana* Sands (1997: 433) but it differs from this species in its long internodes, 4.5–10 cm (vs. 0.6–0.9 cm as in *B. bruneiana*), 5–6 veins on either side of the midrib (vs. 3–4 veins), the male flowers are larger and have 4 tepals, the outer pair *c*. 10 × 5 mm (vs. with 2 tepals, *c*. 7 × 6 mm) and fruits that are longer than broad, *c*. 15 × 10 mm (vs. broader than long, 7–9 × 9–13 mm, as in *B. bruneiana*). Type: *Rimi R. SNP A 16607*, Borneo. Sabah, Tawau District, Tawau Hills Park, near by the Head Office and along the trail to the Mt. Lucia, 4 March 2004 (holotype SNP!; isotype SAN!). **(Figs. 7 & 8)**

Erect herb, rarely branched. Stem reddish brown, 30–60 cm tall, 6–8 mm thick, slightly swollen at nodes, woody, appressed hairs, yellowish green, internodes 4.5–10 cm. Stipules pale green with red, dense hairs, narrowly triangular, *c*. 10 × 5 mm, margin entire, apex acuminate, acumen *c*. 0.2 mm. Leaves alternate, distant, 4.5–10 cm apart; petiole dull red becoming brown, short *c*. 0.5–1 cm long; lamina plain dull or dark green above and dark red or maroon beneath, oblong-lanceolate, 10–12.5 × 3–5 cm, broad side *c*. 1.5–3 cm, apex acuminate, acumen *c*. 0.5–1 cm, base acute, margin dentate; venation pinnate, 5–6 pairs, branching more than halfway to margin, beneath slightly prominent, impressed above, prominent below, reddish, hairy. Inflorescences axillary, 1 female flower stalk arising from the lower to the middle axils, male flower a simple cyme, 1–2 flowers from the middle to the upper axils. Bract pair red, *c*. 5 × 3 mm, lanceolate, margin hairy, apex acuminate, persistent. Male flowers: pedicels *c*. 0.5 cm long, reddish–green; 4 tepals, outer 2 tepals *c*. 10 × 5 mm, inner 2 tepals *c*. 2.5 × 4–5 mm, pinkish-red, with short hairs outside, cluster shorter than the leaves. Female flowers (rarely fully open) red, sometimes pinkish white: pedicels 7–12 mm; hairy ovary crimson, *c*. 11–15 × 12–18 mm, hairy; tepals 5, *c*. 8–10 × 3–5 mm, red hairy outside. Capsules pendent, broadly oblong, *c*. 1.5 × 1 cm, 3 wings, equal, 3–5 mm wide; pedicels *c*. 1–1.2 cm, bent horizontally to downwards with the fruit held below the leaves. Seeds barrel-shaped *c*. 0.5 × 0.3 mm, columnar cells more than half of the seed length.

ETYMOLOGY. Named in honour of Dr Jamili Nais, ecologist and currently the Director of Sabah Parks.

ECOLOGY. Lowland to lower montane forest at 200–830 m elevation in shady areas.

DISTRIBUTION. Borneo. Endemic to Sabah (Tawau Hills Park).

CONSERVATION STATUS. Least Concern. It is found in Tawau Hills Park, which is a totally protected area.

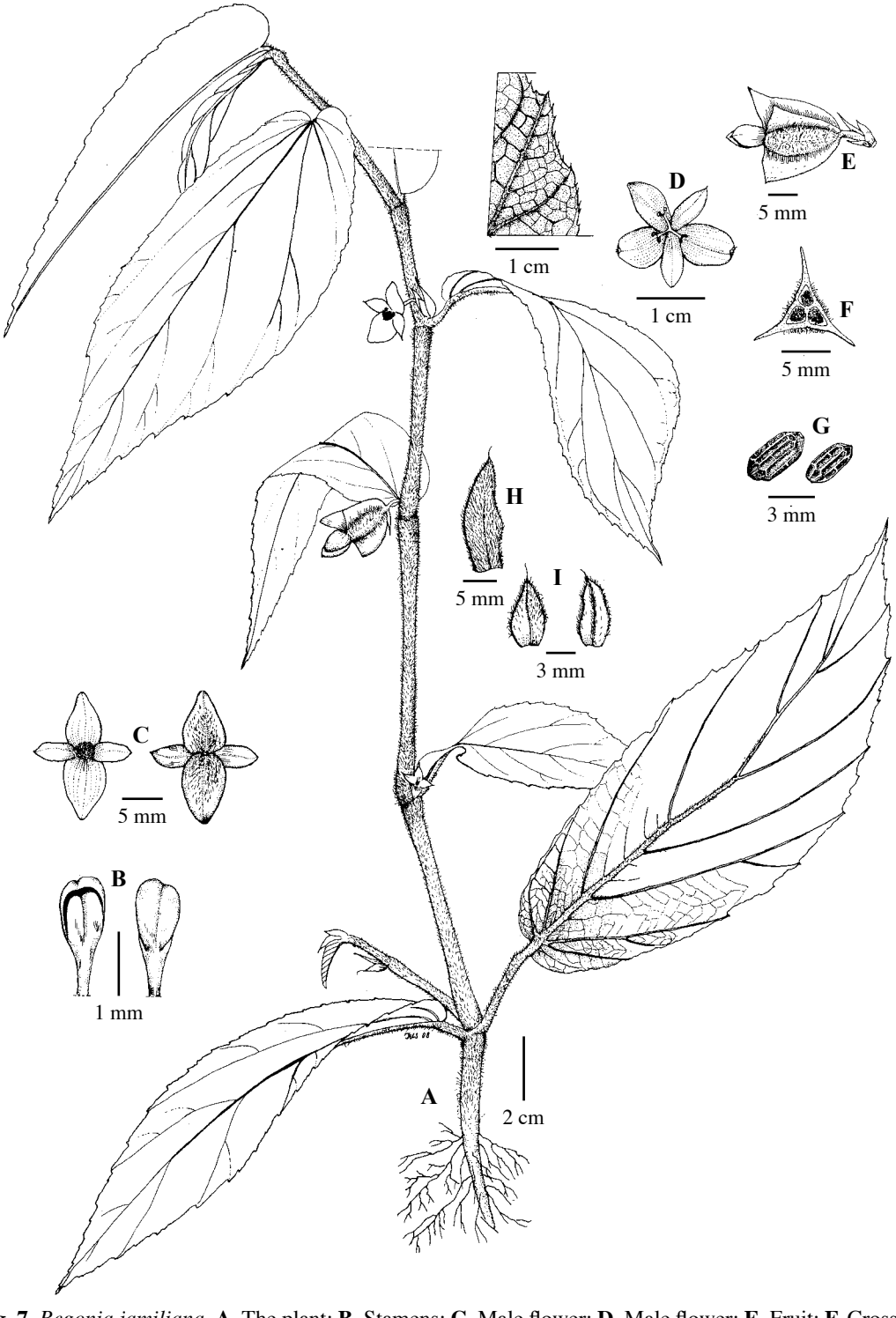


Fig. 7. *Begonia jamiliana*. **A.** The plant; **B.** Stamens; **C.** Male flower; **D.** Male flower; **E.** Fruit; **F.** Cross-section of ovary; **G.** Seeds; **H.** Stipule; **I.** Bract.

SPECIMENS EXAMINED—BORNEO. SABAH: Tawau District: Tawau Hills Park — Mt. Maria Valley, *Rimi et al. KNP 14214* (SNP); near by the Head Office and along the trail to the Mt. Lucia, *Rimi R. SNP A 16607* (holotype SNP!; isotype SAN!); Trail to Mt. Lucia, *Masrina Adin, KNP 10544* (SNP, SAN); Lowland Garden, *Rimi et al. SP 09761* (SNP), *Simun L & Evertius E*, *KNP A 14703* (SNP), *V. Jamnicky et al. VLJ 8* (SNP), *Rimi & Kinahim, SP 18628* (SNP); Trail to Hot springs, *Dolois Sumbin, KP 09373* (SNP); Waterfall Bukit Gelas, *Rahimah et al. SP 18048* (SNP); Trail to HQ, *Shahida & Siti Farhana, BORH 0623*, (SNP, SAN, BORH); Trail to Gelas Waterfall, *Masrina et al. SP 10517* (SNP), *Masrina, SP 10515* (SNP).

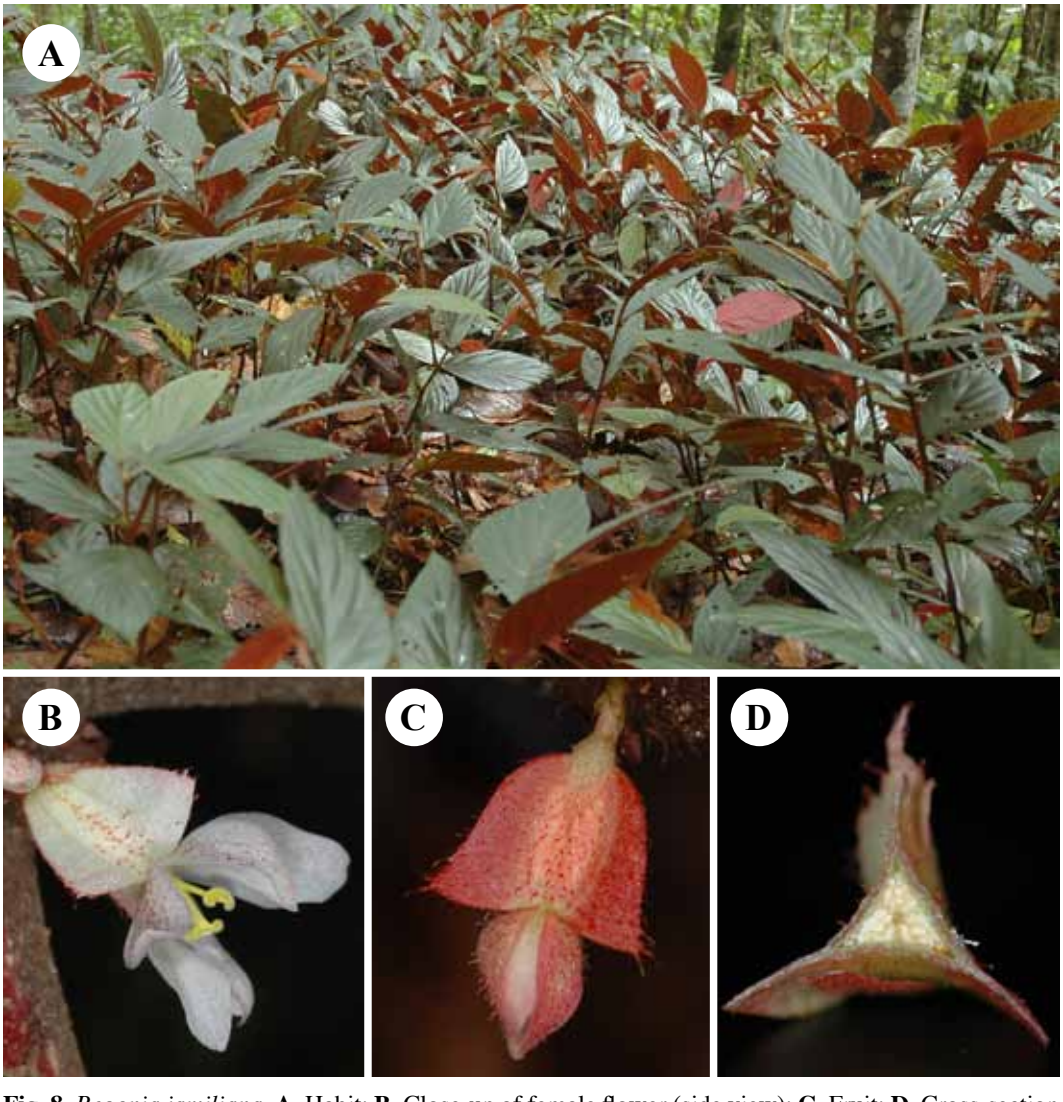


Fig. 8. *Begonia jamiliana*. **A.** Habit; **B.** Close-up of female flower (side view); **C.** Fruit; **D.** Cross-section of fruit (ovary). All photos by Ramlan Miadin.

NOTES. It has two colour forms. The green form, commonly grows at 600 m and above. Its lamina is green beneath and the male and female flowers have white to pinkish tepals. The magenta-red form grows at the lower elevations (200–700 m) and its lamina is maroon-red beneath and the flowers are more pinkish to reddish.

7. Begonia lamriana Rimi **sp. nov.** (Section *Petermannia*)

Like *B. ruthiae* S. Julia, *B. lamriana* is also a short herb less than 40 m tall. Both are similar in having dark or deep green leaves and deep magenta on the lower leaf surface. However. the silvery margin does not occur on *B. lamriana*. Both have inflorescences held above the leaves. In addition, *B. lamriana* branches from the lower half of the stems (*B. ruthiae* is rarely branched), its leaves are larger, 10–14 × 9.5–11 cm (vs. 7–10.5 × 4.7–8.5 cm in *B. ruthiae*), the tepals are smaller, 5–6 mm long in male flowers and 7–10 mm long in female flowers (vs. 9–12 mm in male flowers and 12–13 mm in female flowers) and the capsules have a short stiff stalk 4–9 mm (vs. a long thread-like stalk, 14–22 mm as in *B. ruthiae*). Type: *Dolois S et al. SP18653*, Borneo, Sabah, Tawau District, Tawau Hills Park, within the Dipterocarp Plot, 04 March 2004 (holotype SNP!; isotypes SAN!; KEP!). **(Figs. 9 & 10)**

Erect, short herbs, 20–30 cm tall, rooting at the lower nodes. Stems reddish, glabrous, 1–2 branched at the lower stems. Stipules pale red, narrowly triangular *c*. 4–5 × 5–10 mm, margin entire, apex acuminate. Leaves alternate, distant, 4–6 cm apart, 3–4 leaves on every branch, held horizontally; petiole pale red, glabrous, 3.5–5.5 cm, succulent; lamina blackish tinged deep green above with white or red bristles between the veins, magenta beneath, rugose, glossy metallic in life, thinly papery when dry, oblique, broadly oval to orbicular, 10–14 × 9.5–11 cm wide, strongly asymmetric, broad side 5–8 cm wide, basal lobes 25–40 cm, base broadly rounded, apex rounded and sometimes slightly mucronulate, margin finely double-serrate; venation palmate-pinnate, main veins paler, 4–5 veins in basal lobe, 1–2 veins on each side of midrib, branching twice before reaching the margin, impressed above, prominent beneath. Inflorescences protogynous with a single female flower at the base of male inflorescence, axillary, flowers clustered with 2 female flowers on stalk 5–8 cm long and 2–3 clusters of male flowers on stalks 10–15 cm long, clusters shorter than the leaves, glabrous. Bract pair reddish, broadly ovate, *c*. 4 × 5 mm, apex slightly acuminate. Male flowers: tepals 2, pure white or tinged pink, margin entire, broadly ovate, apex rounded, 5–6 mm long, filaments 0.5–1 mm; anthers yellow. Female flowers with reddish stalk 5–8 cm long; ovary rosy pink to reddish, glabrous, oblong, *c*. 10 mm, wing 3, rounded, locules 3, tepals 5, white tinged pink towards the margin, broadly ovate, margin entire, tip rounded, *c*. 7–10 × 6–10 mm, inner similar but almost without hairs and much smaller, 3.5–6 mm; styles 2, styles and stigmas yellow, 2–3 mm long, stigmas U-shaped. Capsules: locules 3, wings 3 equal, thinly fibrous, 2–4 mm wide; pedicel stiff, thin, 4–9 mm long. Seeds barrel-shaped, *c*. 0.1–0.2 mm long, columnar cells more than half the length of seed.

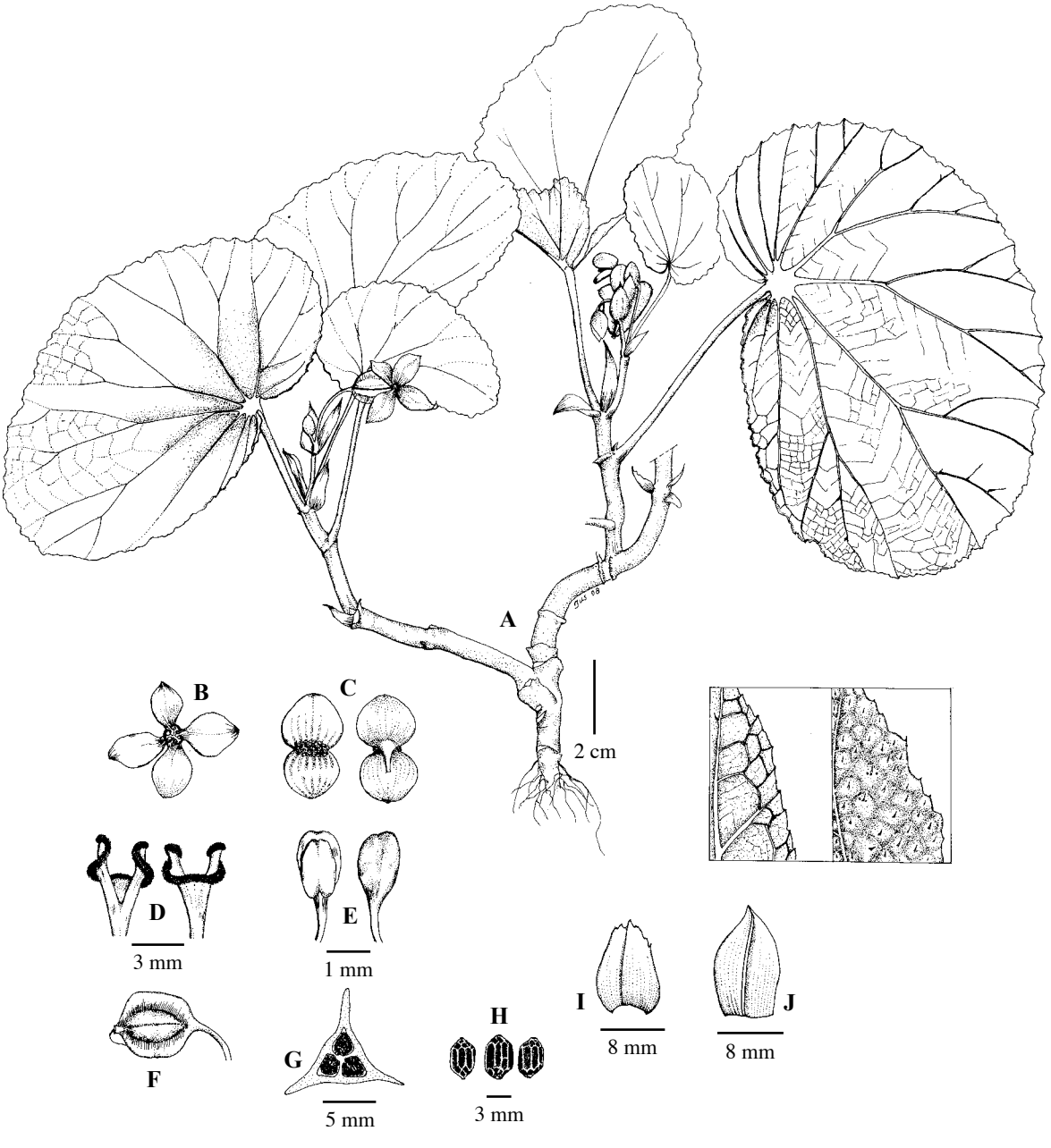


Fig. 9. *Begonia lamriana*. **A.** The plant; **B.** Female flower; **C.** Male flower; **D.** Styles and stigmas; **E.** Stamens; **F.** Fruit; **G.** Cross-section of ovary; **H.** Seeds; **I.** Bract; **J.** Stipule.

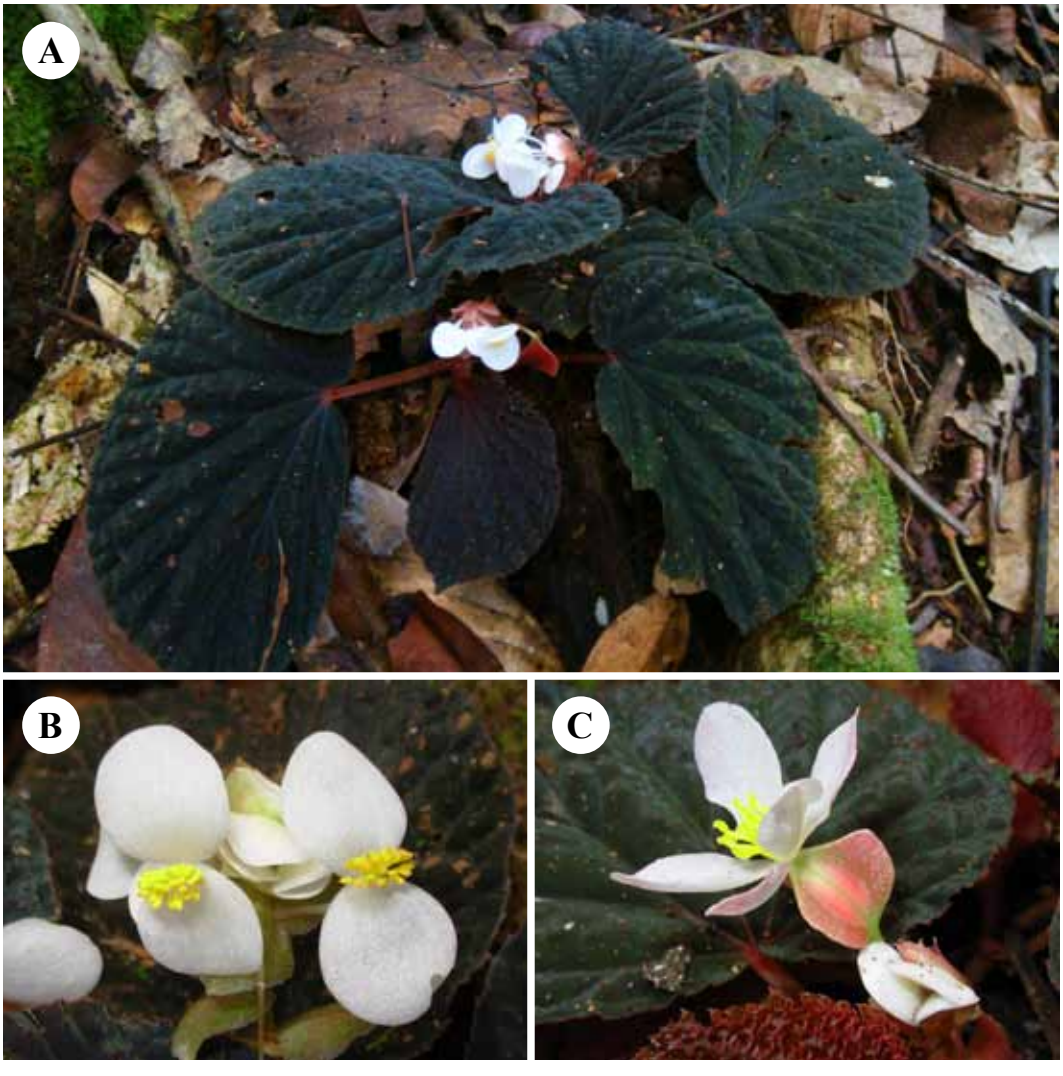


Fig. 10. *Begonia lamriana*. **A.** Habit; **B.** Close-up of male flower; **C.** Close-up of female flower (side view). All photos by Rimi Repin.

ETYMOLOGY. Named in honour of Datuk Lamri Ali, former Director of Sabah Parks, who was very supportive towards the establishment of the Lowland Garden and the collection of potential ornamental native plants from Tawau Hills Park.

ECOLOGY. Lowland to lower montane forest at 200–830 m elevation in shady areas.

DISTRIBUTION. Borneo. Endemic to Sabah (Tawau Hills Park).

CONSERVATION STATUS. Least Concern. It is found in Tawau Hills Park, which is a totally protected area.

SPECIMENS EXAMINED—BORNEO. SABAH: Tawau District: Tawau Hills Park — Mt. Lucia, km 10.5, *Kinahim & Frederick, KNP 14116* (SNP, SAN, KEP); Trail to Mt. Lucia, *Duni & Yabainus, SP 11542* (SNP); Near water Fall, Mt. Lucia, *Handry et al. KNP 13843* (SNP); Trail to Hot Spring, *Dolois et al. KNP 13090* (SNP); Plot Dipterocarpaceae, *Dolois et al. SP 18653* (holotype SNP!; isotypes SAN!; KEP!); Trail 750 m from Tawau Hills HQ, *Noramly et al. BORH 0655* (SNP, BORH); Tawau hills botanical garden, *Simun & Evertius, KNP A 14714* (SNP), *Simun & Evertius, KNP A 14715* (SNP, SAN).

NOTES. This species is striking in its leaf colour, which is always deep green to brown reddish. It has great potential as an ornamental plant.

8. Begonia mariaensis Rimi & Simun **sp. nov.** (Section *Petermannia*)

In its cane-like habit and leaves with narrowly parallel veins, it resembles *B. gomantongensis* Kiew (164: 1998) but it is different in its shorter petioles, 4–9 cm long (vs. 10–16 cm long as in *B. gomantongensis*), its long inflorescences, 24–27 cm long (vs. to 5 cm long), its larger male flowers with 4 tepals, the outer pair *c.* 5 × 3 mm (vs. with 2 tepals, 3.5–4 × 3–3.5 mm), and smaller fruits, *c.* 8 × 7 mm with narrow wings, *c.* 2 mm wide and smooth locules (vs. 17–20 × 13–15 mm with wings 4–5 mm wide and a distinctly verruculose surface). Type: *Rimi R. SNP A 16602*, Borneo, Sabah, Tawau District, Tawau Hills Park, planted at Tawau Hills Lowland Botanical Garden (originally collected from Mt. Maria), 18 December 2009 (holotype SNP!; isotype SAN!). **(Figs. 11 & 12)**

Cane-like begonia, 60–100 cm tall, woody at the base. Stems reddish, 3–6 mm thick, hollow when dry, internodes *c.* 5–7 cm long, shortly hairy, much branched, nodes swollen. Stipules light green, glabrous, triangular, *c.* 7–10 × 3–4 mm, margin entire, apex acuminate, acumen *c.* 1 mm long, persistent. Leaves alternate, oblique, distant, held horizontally; petiole reddish, glabrous, 4–9 cm long, grooved above; lamina light green above, plain pale green, slightly fleshy in life and papery when dry, glossy, asymmetric, *c.* 17–24 cm × 9–13 cm wide, broad side *c.* 7.5–11.5 cm wide, base cordate, basal lobes 5–7.5 cm wide, broadly rounded, margin distantly dentate, apex acuminate, acumen *c.* 1–1.5 cm long; venation palmate-pinnate, veins green, 3 veins on either side of the midrib, 1 pair at the base, 3 veins in basal lobe, impressed above, prominent beneath. Inflorescences protogynous, terminal on lateral branches, glabrous, 24–27 cm long, many flowered raceme; male inflorescences 5 cm long with a few cymose branches, peduncle *c.* 4 cm long, white, male rachis *c.* 1.5–2 cm. Bracteoles on female flower white translucent to greenish, bowl-shaped, concave, *c.* 5 × 4 mm, margin entire, persistent. Bracteoles on male flowers overlapping, white translucent to greenish, caducous, hemispherical, *c.* 3 × 2.5 mm. Male flower: pedicel pale yellow, *c.*

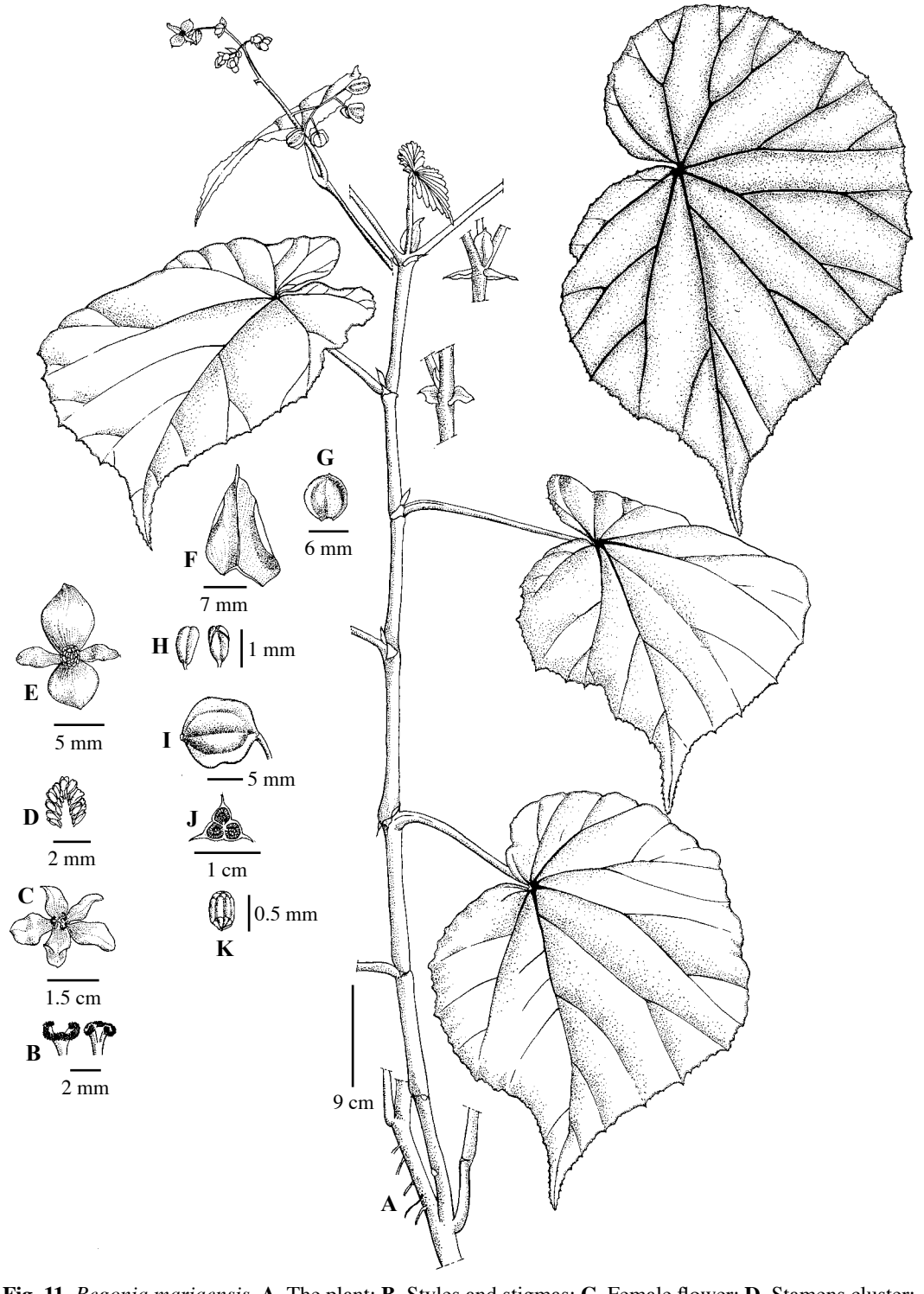


Fig. 11. *Begonia mariaensis*. **A.** The plant; **B.** Styles and stigmas; **C.** Female flower; **D.** Stamens cluster; **E.** Male flower; **F.** Stipule; **G.** Bract; **H.** Stamens; **I.** Fruit; **J.** Cross-section of ovary; **K.** Seed.

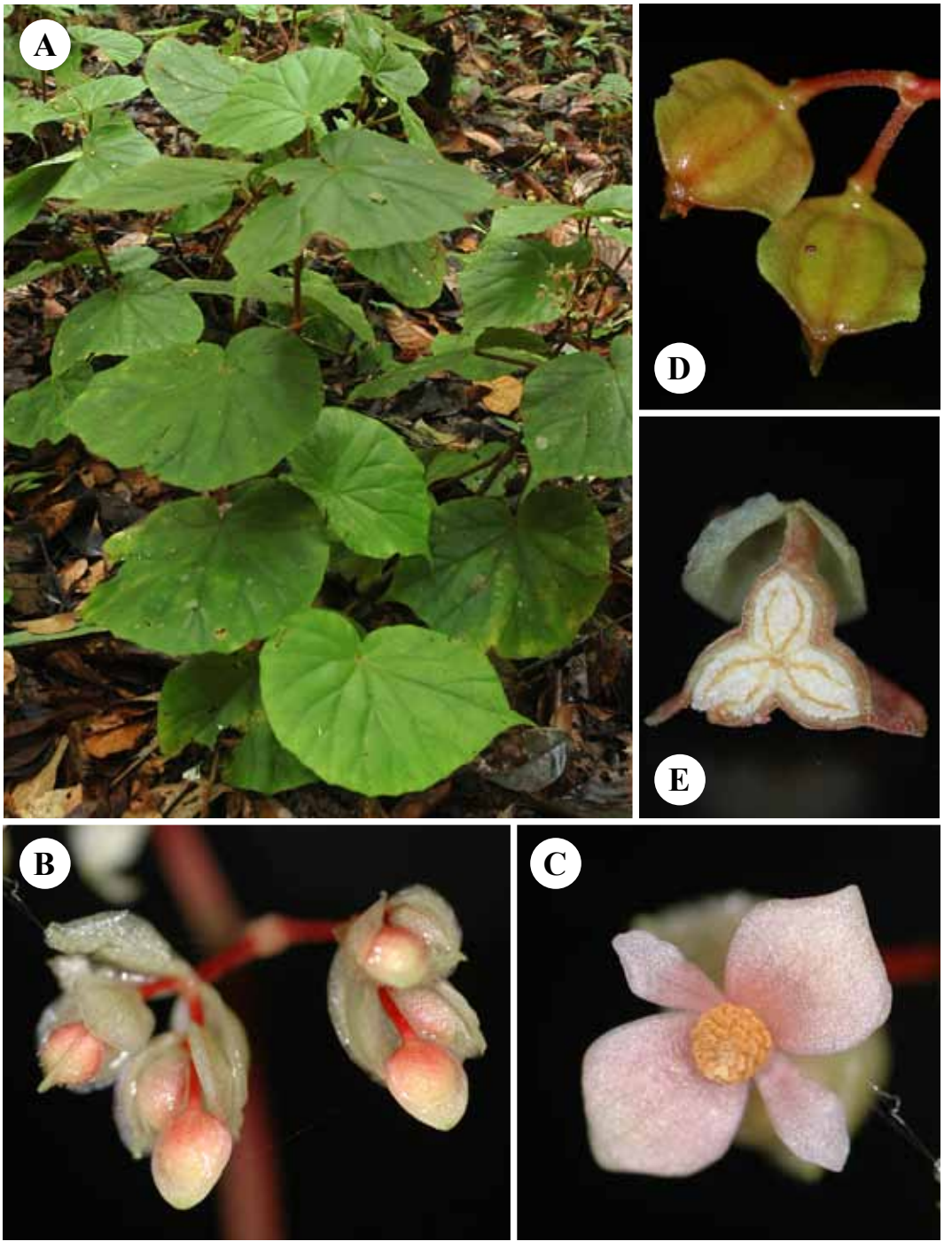


Fig. 12. *Begonia mariaensis*. **A.** Habit; **B.** Male flower; **C.** Close-up of male flower; **D.** Close-up of fruits; **E.** Cross-section of fruit (ovary). All photos by Ramlan Miadin.

1–1.5 cm long; tepals 4, pink, glabrous, margin entire, apex rounded, outer 2 tepals, *c*. 5 × 3 mm; inner 2 tepals, narrowly lanceolate, *c*. 3 × 1.3 mm; stamens *c*. 26, cluster conical, *c*. 3.5 × 2 mm, sessile; filaments pale yellow, *c*. 2 mm long; anthers pale yellow, oblong, *c*. 1 × 0.2 mm, apex emarginate. Female flower: pedicel 1 cm long, reddish; ovary rosy pink to reddish-green, glabrous, oblong, *c*. 8 × 3 cm, wings 3, equal, locules 3, placentas 2 per locule with many ovules on both surfaces; tepals 5, isomorphic, 12–14 × 5–7 mm, oval to narrowly obovate, rosy pink tinged white toward the margin, margin entire, apex rounded acute to obtuse; styles 3, pale green, *c*. 0.5 mm long, divided to base, Y-shaped with twisted tips; stigma pale green to white, papillose forming a twisted band. Capsule dangling, *c*. 8 × 7 mm, glabrous, locules 3, oblong, wings 3, equal, *c*. 2 mm wide, thinly fibrous, dehiscing between the locule and wing; pedicel stiff, *c*. 6–10 mm long. Seeds barrel-shaped, *c*. 0.5 × 0.2 mm, columnar cells more than half the length of seed.

ETYMOLOGY. Named for the locality, Mt. Maria, from where it was first collected.

ECOLOGY. Primary forest, on steep slopes along river, 1020 m elevation.

DISTRIBUTION. Borneo. Endemic to Sabah (Tawau Hills Park).

CONSERVATION STATUS. Least Concern. It is found in Tawau Hills Park, which is a totally protected area.

SPECIMEN EXAMINED—BORNEO. SABAH: Tawau District, Tawau Hills Park, Originally collected from Mt. Maria and planted at Tawau Hills Lowland Botanical Garden, December 2009, *Rimi R. SNP A 16602* (holotype SNP!; isotype SAN!).

NOTES. It is only known from the type specimen. It has a particularly long inflorescence.

9. Begonia paracauliflora Rimi, C.-I. Peng & S.M. Ku **sp. nov.** (Section *Petermannia*)

Fruits with 6 wings are very unusual in *Begonia*. Usually there are 3 wings (or in some cases 1 or 2 do not develop) but fruits with 3 fully developed wings and 3 smaller wings protruding from junctions of carpels in Borneo, is known only in *B. hexaptera* Sands (1997). *Begonia paracauliflora* is also similar to *B. hexaptera* in its low habit, size and shape of the leaves that are either green or reddish brown beneath, subsessile female flowers, male flowers in few-flowered cymes, and small fruits with 6 wings, but it is different in its longer petioles, 8–13 mm long (vs. 2.5–7 mm in *B. hexaptera*), and its male flowers with 4 larger tepals, the outer pair 11–12 × 8.5–12 mm (vs. with 2 tepals, 6–7 × 9 mm). Type: *Ching-I. Peng, Shin-Ming Ku & Rimi Repin 21989*, Borneo, Sabah, Tawau District, Tawau Hill Park Headquarters to Waterfall Trail, 04° 23’ 52.5” N, 117° 53’ 16.4” E, 17 December 2008 (holotype SNP!; isotype HAST!). **(Figs. 13 & 14)**

Erect herb. Stems 20–30 cm tall, usually unbranched or rarely branched near the ground, 7–9 mm thick, hispid or hirsute, hairs 2–5 mm long, more or less reddish, internodes 1–2 cm long. Stipules obliquely ovate, 13–17 × 6–9 mm wide, margin serrulate-ciliate, apex acute, sparingly long-pilose along midrib, persistent and often marcescent. Leaves alternate; petiole short, 0.8–1.3 cm long, hispid; lamina oblique, oblong-obovate or widely so, (5–)11–15 × (2.3–)4–5.5 cm, base rounded or slightly cordate on the broader side, cuneate or obtuse

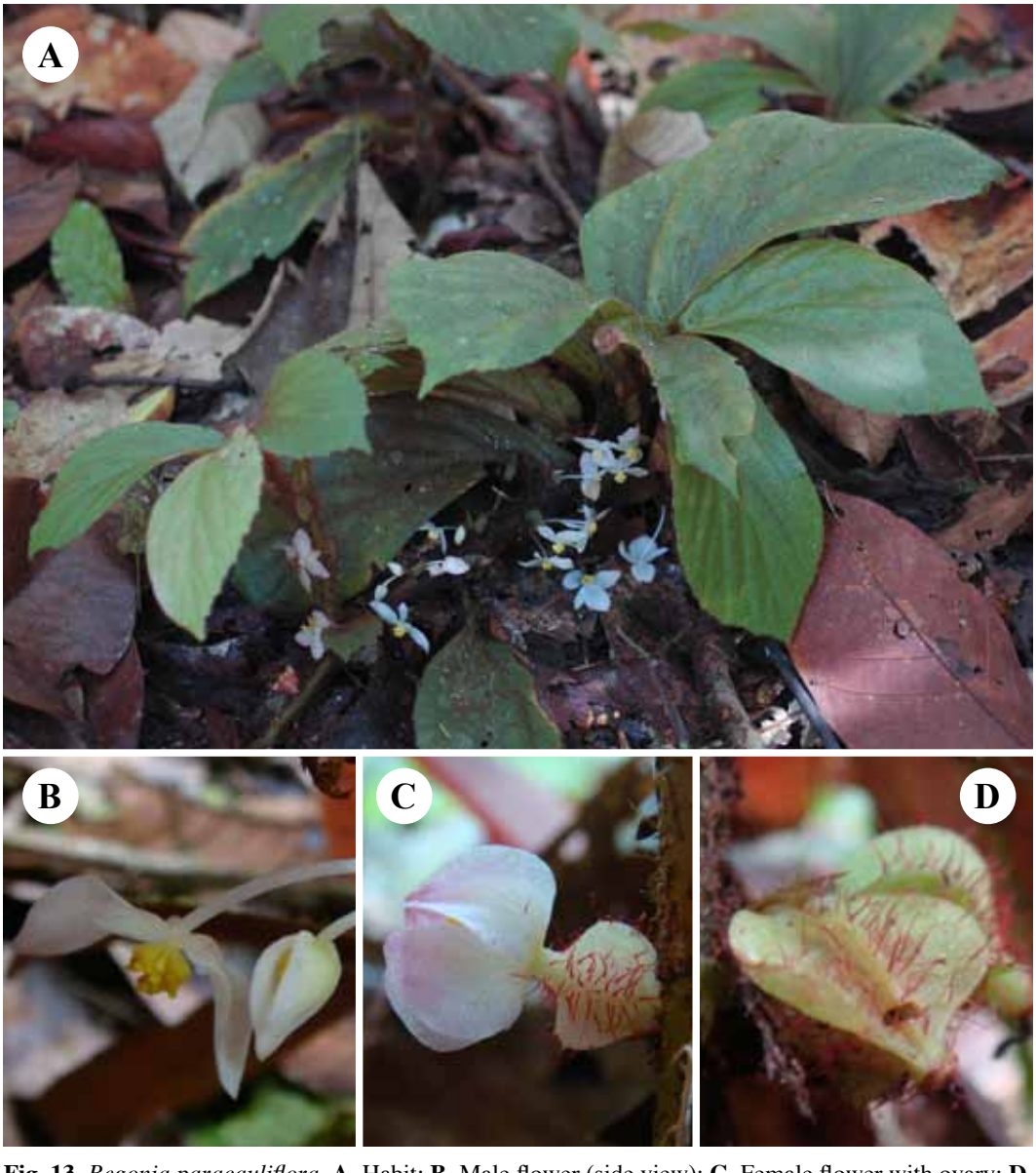


Fig. 13. *Begonia paracauliflora*. **A.** Habit; **B.** Male flower (side view); **C.** Female flower with ovary; **D.** Fruit. All photos by Rimi Repin.

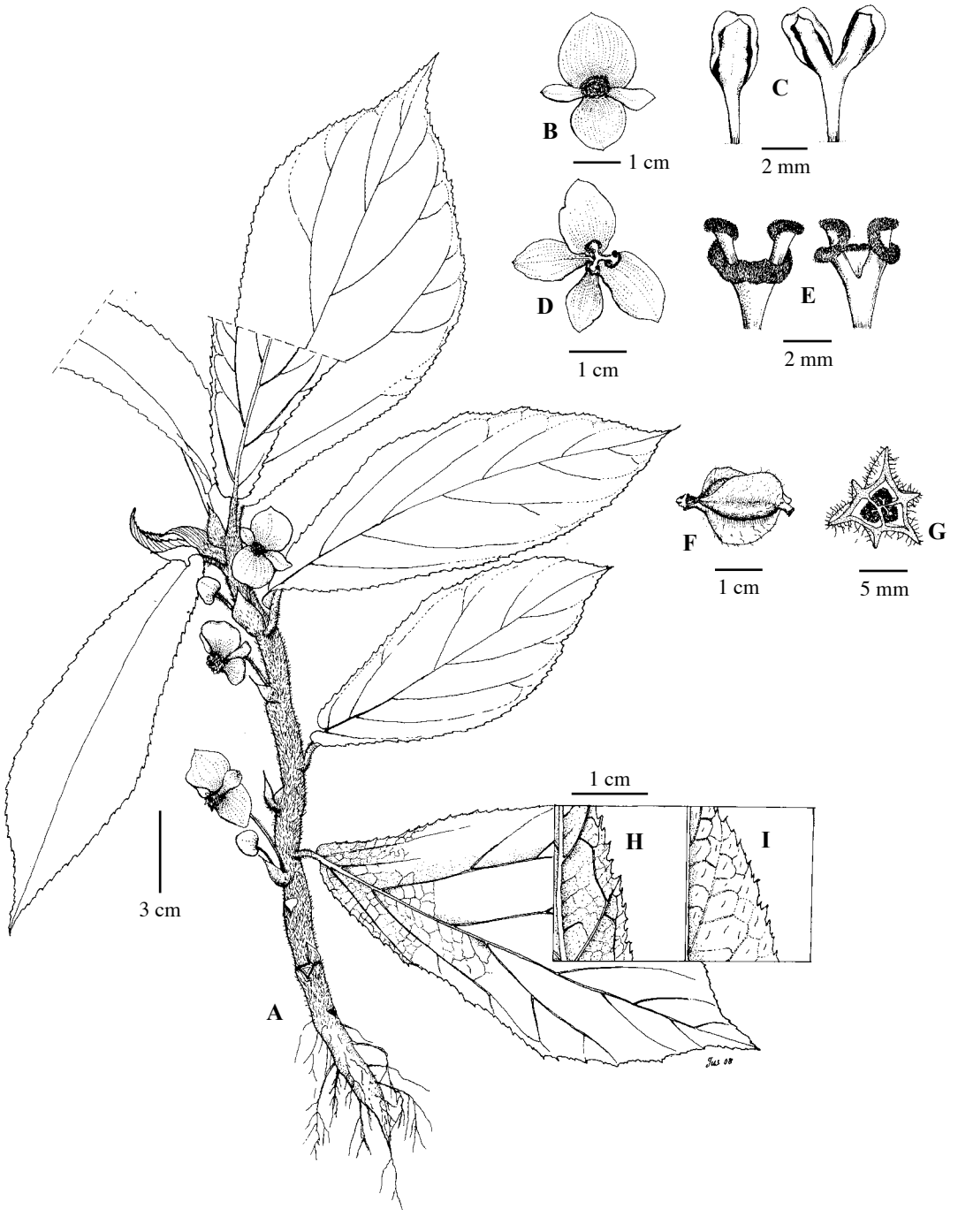


Fig. 14. *Begonia paracauliflora*. **A.** The plant; **B.** Male flower; **C.** Stamens; **D.** Female flower; **E.** Styles and stigmas; **F.** Fruit; **G.** Cross-section of ovary; **H.** Lower leaf surface; **I.** Upper leaf surface.

on the narrower side, margin irregularly serrate or double-serrate, each tooth bristle-tipped, apex acute to acuminate, dark green above and red beneath (in some plants, leaves green above and greenish beneath), adaxially sparsely to moderately setose, hairs 0.5–1.8 mm long, reddish, abaxially hispid or setose on major veins, longer and more frequent towards the petiole; venation pinnate, lateral veins 3–5 on each side of the midrib. Inflorescences very short, axillary, usually unisexual, male flowers in dense cymose clusters. Bracts 3–5 pairs, ovate, *c*. 5–8 × 3–5 mm, margin serrulate-ciliate, apex aristate. Female flowers occurring singly or sometimes in pairs, usually arising at the lower nodes. Male flowers: pedicel *c*. 15–20 mm long, tepals 4, white or slightly pinkish, decussate, outer two broadly ovate to orbicular, 11–12 × 8.5–12 mm, abaxially reddish pilose, inner two oblanceolate to narrowly obovate, 7–11 × 4–5 mm; stamens *c*. 20–35, nearly golf-club shaped, cluster sessile, filaments 1–2 mm long (central stamens longer), anthers obovoid to oblong, yellow, *c*. 1–1.3 × 0.6–0.8 mm, apex subemarginate. Female flowers subsessile, pedicel *c*. 1 mm long; ovary trigonous-ellipsoid, reddish hirsute, 6-winged, 3 larger wings protrude from midrib of carpels, the other 3 smaller wings protrude from junctions of carpels, with a short terminal beak; tepals 5 or 6, white or slightly pinkish, caducous, unequal or subequal, obovate, oblong, or oblanceolate, the largest 7–10 × 4.5–5 mm, the smallest 6–8 × 2.5–3 mm; styles 3, yellow, 4.5–7 mm long, at their base fused, *c*. 0.5–1 mm long, each bifid or fan-shaped; styles persistent, 3-locular, placentas 2 per locule. Capsules ellipsoid, 10–14 × 3–5 mm (excluding wings), dehiscing along the junction with the wings, wings 6, larger wings 4–5 mm long, smaller wings 1–1.5 mm long. Seeds numerous, brown, mostly obovoid and ellipsoid, minute.

ETYMOLOGY. Greek, *para-* similar to; indicating its superficial resemblance to the habit of *Begonia cauliflora* Sands.

ECOLOGY. Primary forest, under forest canopy, 100–800 m elevation.

DISTRIBUTION. Borneo. Endemic to Sabah (Tawau Hills Park).

CONSERVATION STATUS. Least Concern. It is found in Tawau Hills Park, which is a totally protected area.

SPECIMENS EXAMINED—BORNEO. SABAH: Tawau District: Tawau Hills Park — Along trail from Tawau Hill Park Headquarter to Waterfall, *Ching-I. Peng, Shin-Ming Ku & Rimi Repin 21989* (holotype SNP!; isotype HAST!)*, Ching-I. Peng, Shin-Ming Ku & Rimi Repin 21990* (HAST); Lowland Garden, *Rimi & Kinahim, SP 19169* (SNP, SAN), *Simun & Evertius, KNP A 14707* (SNP, SAN), *Simun & Evertius, KNP A 14701* (SNP), *Rimi Repin, KNP 13879* (SNP), *Rimi Repin, KNP 13878* (SNP); Balung, route to Hot Springs, *Kinahim & Handry, SNP 25243* (SNP, SAN).

NOTES. The 6-winged fruit is the startling character of this species.

10. Begonia postarii Kiew (1998: 165). Type: *Kiew & Lim RK 4221,* Borneo, Sabah, Kinabatangan District, Bukit Panggi, 19 September 1996 (holotype SAN!; isotype SING).

ETYMOLOGY. Named in honour of Postar Jaiwit, research assistant in the Herbarium, Forest Research Centre, a diligent plant collector, who discovered this species.

ECOLOGY. Lowland mixed dipterocarp forest. Previously, it was known only from limestone hills along the Kinabatangan River (Kiew, 1998).

DISTRIBUTION. Borneo. Endemic to Sabah. Found in the Kinabatangan District (Bukit Panggi); Lahad Datu District (Danum Valley Conservation Area); and Tawau District.

CONSERVATION STATUS. Least Concern. Widespread and it is also found in Tawau Hills Park, which is a totally protected area.

SPECIMENS EXAMINED—BORNEO. SABAH: Tawau District: Tawau Hills Park — HQ area, *Dolois et al. KNP 13497* (SNP), *Simun & Evertius, KNP A 14712* (SNP); Lowland Garden, *Simun & Evertius, KNP A 14709* (SNP), *Rimi & Rahimah, SP 09753* (SNP); Sungai Apas, *Simun et al. KNP A 14719* (SNP), *Simun et al. KNP A 14718* (SNP); Balung, Dipterocarp Plot, *Dolois et al. KNP A 14729* (SNP, SAN); Balung, Sungai Papaya/Sungai Vanila, *Simun et al. KNP A 14723* (SNP). Kinabatangan District: Bukit Panggi, *Kiew & Lim RK 4221* (holotype SAN!; isotype SING).

NOTES. It is a striking species in its broad and softly hairy leaves with long inflorescences, held above the leaves with many tiny deep red male flowers.

11. Begonia renek Rimi **sp. nov.** (Section *Petermannia*)

Similar to *B. dimorpha* S. Julia (2015) in its large cane-like habit, young spotted leaves, fruit shape, and fruits that have long thread-like stalks, but *B. renek* differs in its larger leaves, 17–24 × 9–13 cm (vs. 10.3–16.3 × 6.2–8 cm as in *B. dimorpha*), and male flowers with 4 tepals and *c*. 26 stamens (vs. 2 tepals and 56–60 stamens as in *B. dimorpha*). Type: *Kinahim & Handry, SNP 25242*, Borneo, Sabah, Tawau District, Tawau Hills Park, Balung station, route to Hot Springs, 27 April 2012 (holoytpe SNP!). (**Figs. 15 & 16**)

Cane-like begonia, 60–150 cm tall, woody at the base. Stems reddish, 3–6 mm thick, hollow when dry, internodes 5–7 cm long, shortly hairy, much branched, nodes swollen. Stipules light green, glabrous, triangular, 7–10 × 3–4 mm, margin entire, apex acuminate, acumen *c*. 1 mm long, persistent. Leaves alternate, oblique, distant, held horizontally; petiole reddish, glabrous, 4–9 cm long, grooved above; lamina of juvenile leaves with rows of white or pink

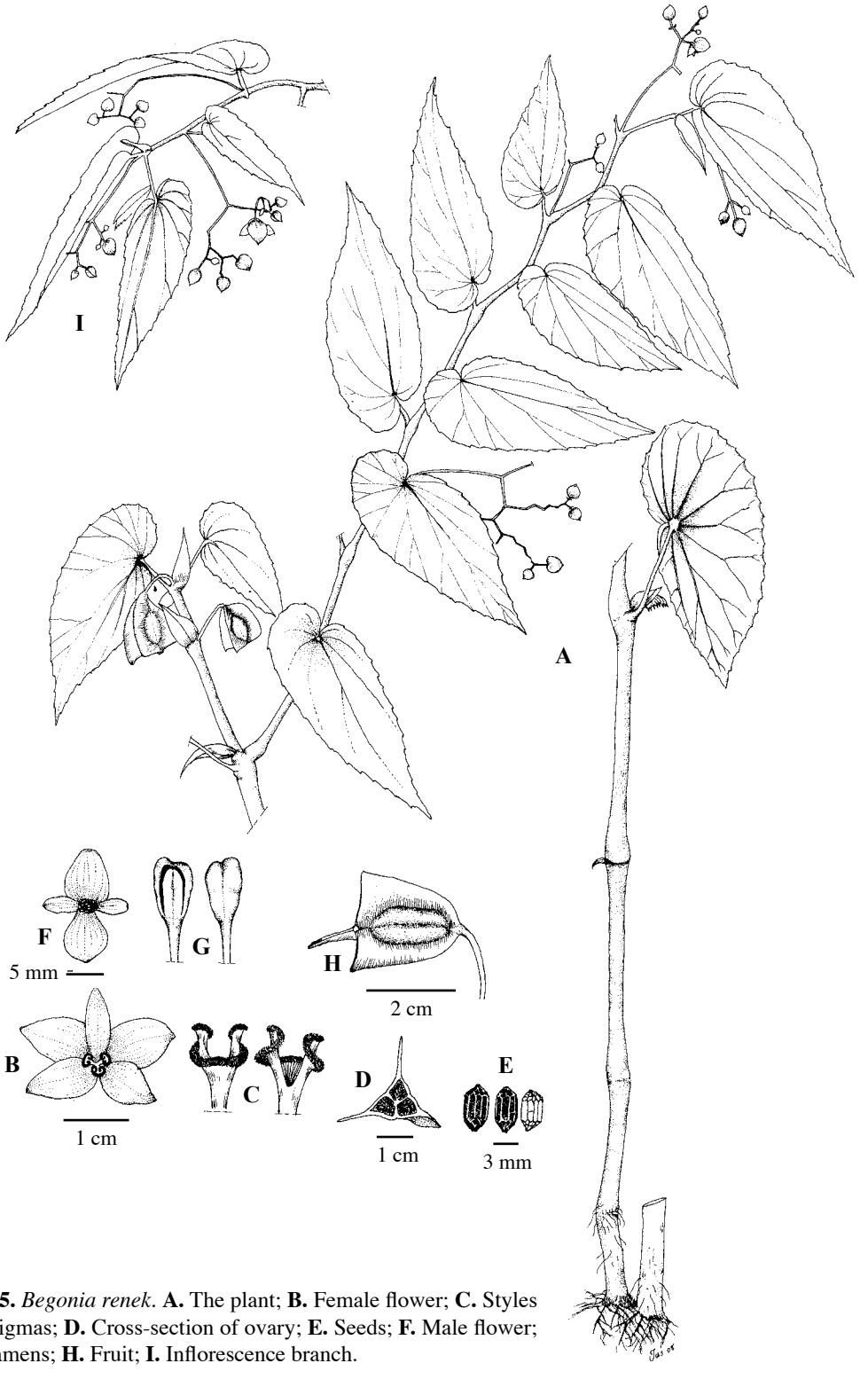


Fig. 15. *Begonia renek*. **A.** The plant; **B.** Female flower; **C.** Styles and stigmas; **D.** Cross-section of ovary; **E.** Seeds; **F.** Male flower; **G.** Stamens; **H.** Fruit; **I.** Inflorescence branch.

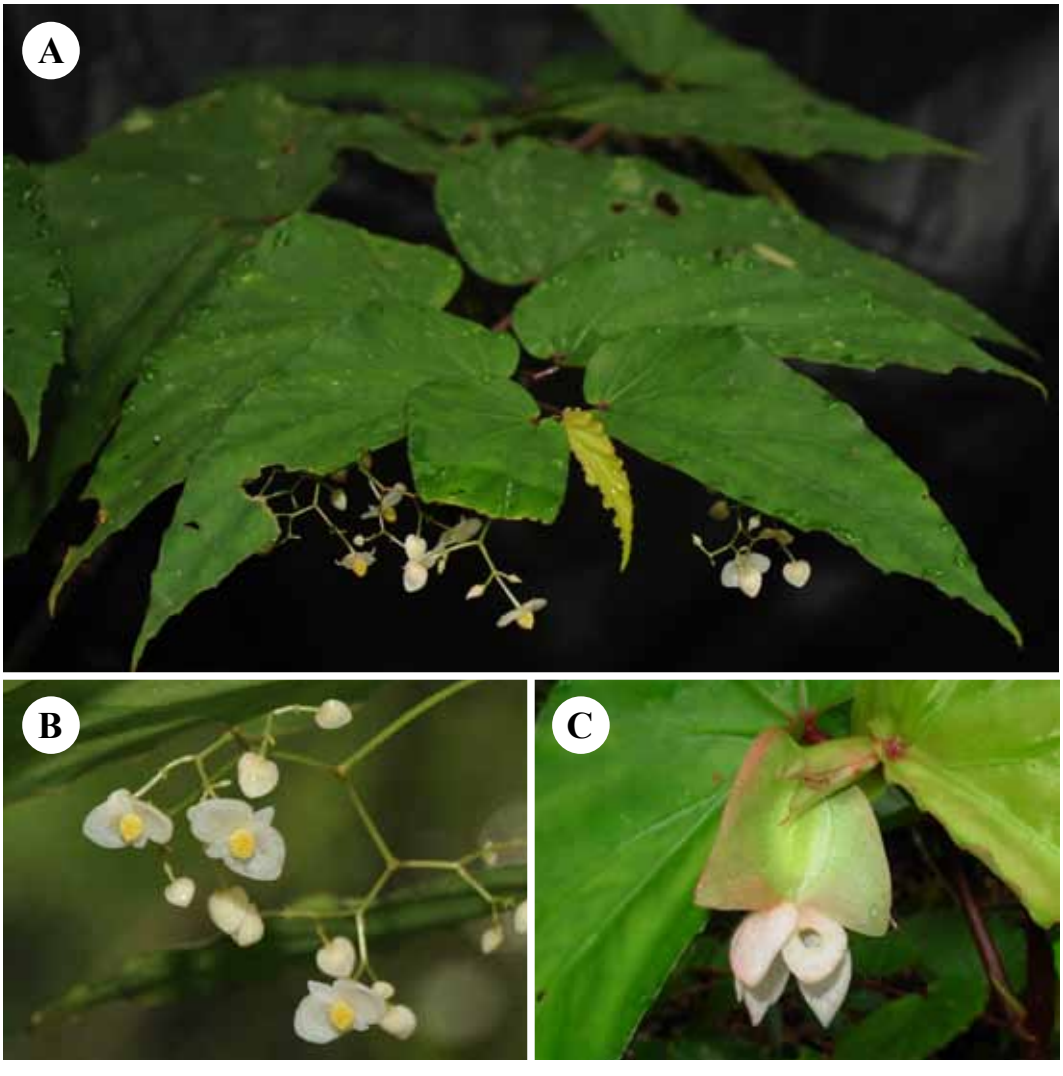


Fig. 16. *Begonia renek*. **A.** Habit; **B.** Close-up of male flower (side view); **C.** Female flower (side view). All photos by Rimi Repin.

spots between the veins and with a white or pink line around the margin, adult leaves plain light green above, pale green beneath, slightly fleshy in life, papery when dry, slightly glossy, broadly ovate, asymmetric, 17–24 × 9–13 cm, broad side 7.5–11.5 cm wide, base cordate, basal lobes 5–7.5 cm wide, broadly rounded, margin dentate distantly, apex acuminate, acumen 1–1.5 cm long; venation palmate-pinnate, veins green, 3 veins on either side of the midrib, 1 pair at the base, 3 veins in basal lobe, impressed above, prominent beneath. Inflorescences protogynous, terminal on lateral branches, many-flowered glabrous raceme;

male inflorescences 5–7 cm long with a few cymose branches, rachis 1.5–2 cm long; peduncle *c*. 4 cm long, white. Bracteoles on male flowers overlapping, white translucent to greenish, hemispherical, *c*. 3 × 2.5 mm, caducous, bracteoles on female flowers white translucent to greenish, bowl-shaped, concave, *c*. 5 × 4 mm, margin entire, persistent. Male flowers: pedicel pale yellow, 10–15 mm long; tepals 4, pink, glabrous, margin entire, apex rounded, outer 2 tepals, *c*. 3 × 5 mm, inner 2 tepals, narrowly lanceolate, *c*. 3 × 1.3 mm; stamens *c*. 26, cluster conical, *c*. 3.5 × 2 mm, sessile; filaments pale yellow, *c*. 0.2 mm long; anthers pale yellow, oblong, *c*. 1 × 0.2 mm, apex emarginate. Female flowers: pedicel reddish, *c*. 2.5–4 cm long; ovary rosy pink to reddish green, glabrous, oblong, *c*. 8 × 3 cm, wings 3, equal, locules 3, placentas 2 per locule with many ovules on both surfaces; tepals 5, isomorphic, *c*. 12–14 × 5–7 mm, oval to narrowly obovate, rosy pink tinged white towards the margin, margin entire, apex rounded, acute to obtuse; styles 3, pale green, *c*. 0.5 mm long, divided to base, Y-shaped with twisted tips; stigma pale green to white, papillose. Capsules glabrous, broadly triangular, 2–3.2 × 1.8–2.5 cm, wings equal, narrowed proximally, truncate distally, tip acute, 0.7–1.0 cm wide, thinly fibrous, dehiscence between locule; pedicels thread-like, 2.5–4.5 cm long. Seeds barrel-shaped, *c*. 0.5 × 0.2 mm, columnar cells more than half the length of seed.

ETYMOLOGY. Named for its characteristic shrubby habit, with many branches and leaves. *Renek* means ‘shrub’ in Malay.

ECOLOGY. Primary forest, under forest canopy, 100–800 m elevation.

DISTRIBUTION. Borneo. Endemic to Sabah (Tawau Hills Park).

CONSERVATION STATUS. Least Concern. It is found in Tawau Hills Park, which is a totally protected area.

SPECIMENS EXAMINED—BORNEO. SABAH: Tawau District: Tawau Hills Park — Balung, route to Hot springs, *Kinahim & Handry, SNP 25293* (SNP, SAN); Balung, route from Sub-Station Balung 30 m to Permanent Plot, *Dolois Sumbin, KNP A 17726* (SNP); Balung, route from Sub-Station to Mt. Pyramid, *Rimi et al. SNP 25216* (SNP); Balung station, route to Hot Springs, *Kinahim & Handry, SNP 25242* (holoytpe SNP!); Balung, *Dolois et al. KP 09017 (*SNP, SAN); Trail to Bukit Bombalai, *Rahimah et al. SP 17930* (SNP); Bukit Bombalai, *Dolois et al. SP 18021* (SNP, SAN, KEP), *Dolois et al. SP 18022* (SNP, SAN, KEP); Poreg, Merotai Kanan Kecil, *Dolois et al. SNP 16783* (SNP, SAN, KEP); Hot Spring area, *Simon et al. SP 10541* (SNP, SAN).

NOTES. The juvenile plants have bronzy spots, some older leaves on the lower branches retain the spots but most of the older leaves become plain green. Among the species occurring in Tawau Hills Park, this species has large fruits that hang down on fine thread-like stalks.

12. Begonia simunii Rimi **sp. nov.** (Section *Baryandra*)

Similar to *B. bernadusii* V.S. Guanih (2015) in its rhizomotous habit and rosette of succulent leaves but *B. simunii* differs in its broader leaves, 15–18 cm wide (vs. 12.7–15.5 cm wide as in *B. bernadusii*), its entire leaf margin (vs. crenate as in *B. bernadusii*), longer peduncles 25–32 cm long (vs. 15–26 cm long), and large stamen number, 82 (vs. 30 in *B. bernadusii*). Type: *Kinahim S. & Handry M., SNP 25246*, Borneo, Sabah, Tawau District, Tawau Hills Park, Balung River, 27 April 2012 (holotype SNP!; isotype SAN!). (**Figs. 17 & 18**)

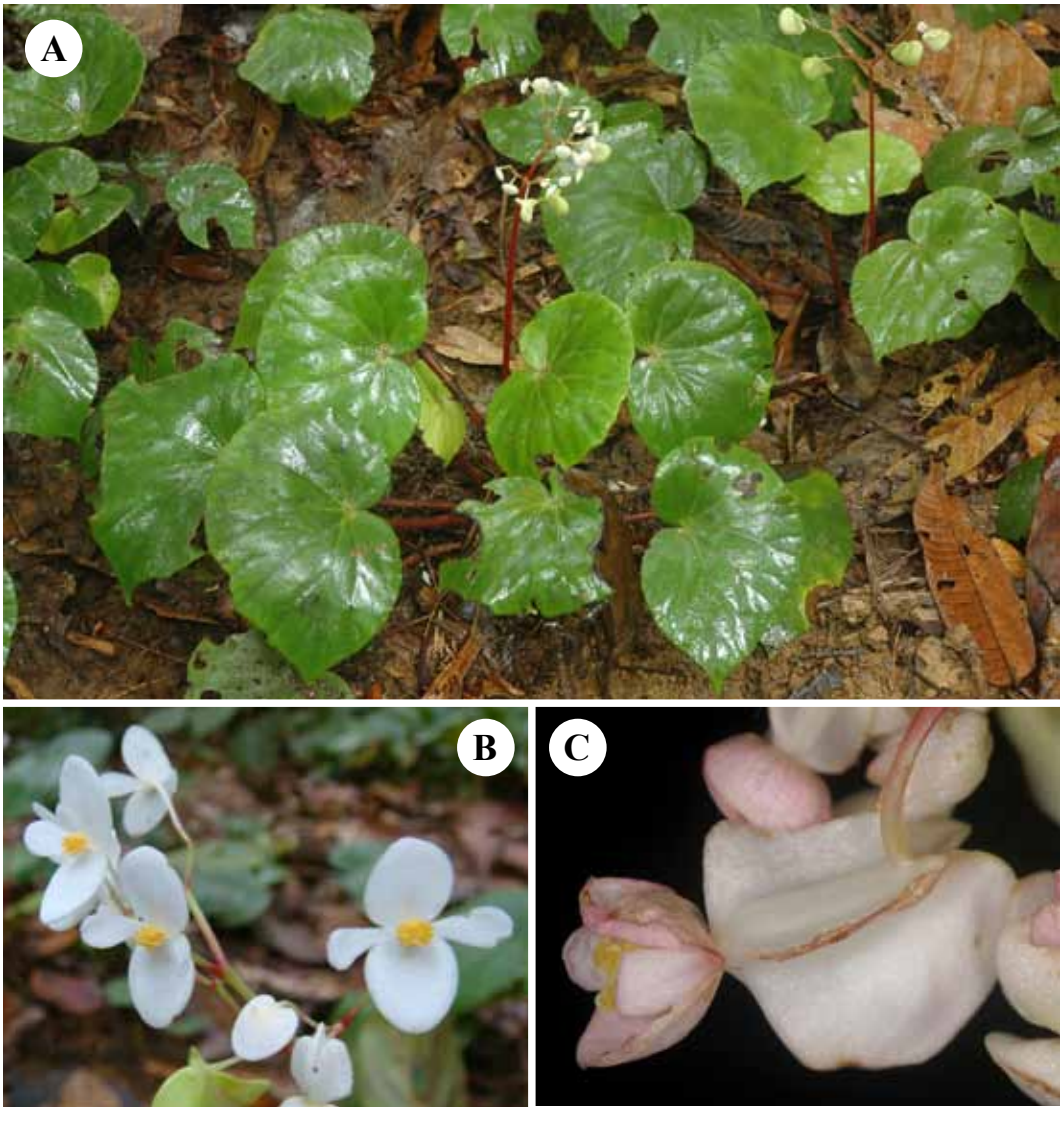


Fig. 17. *Begonia simunii*. **A.** Habit; **B.** Male flower; **C.** Female flower (side view). All photos by Ramlan Miadin.

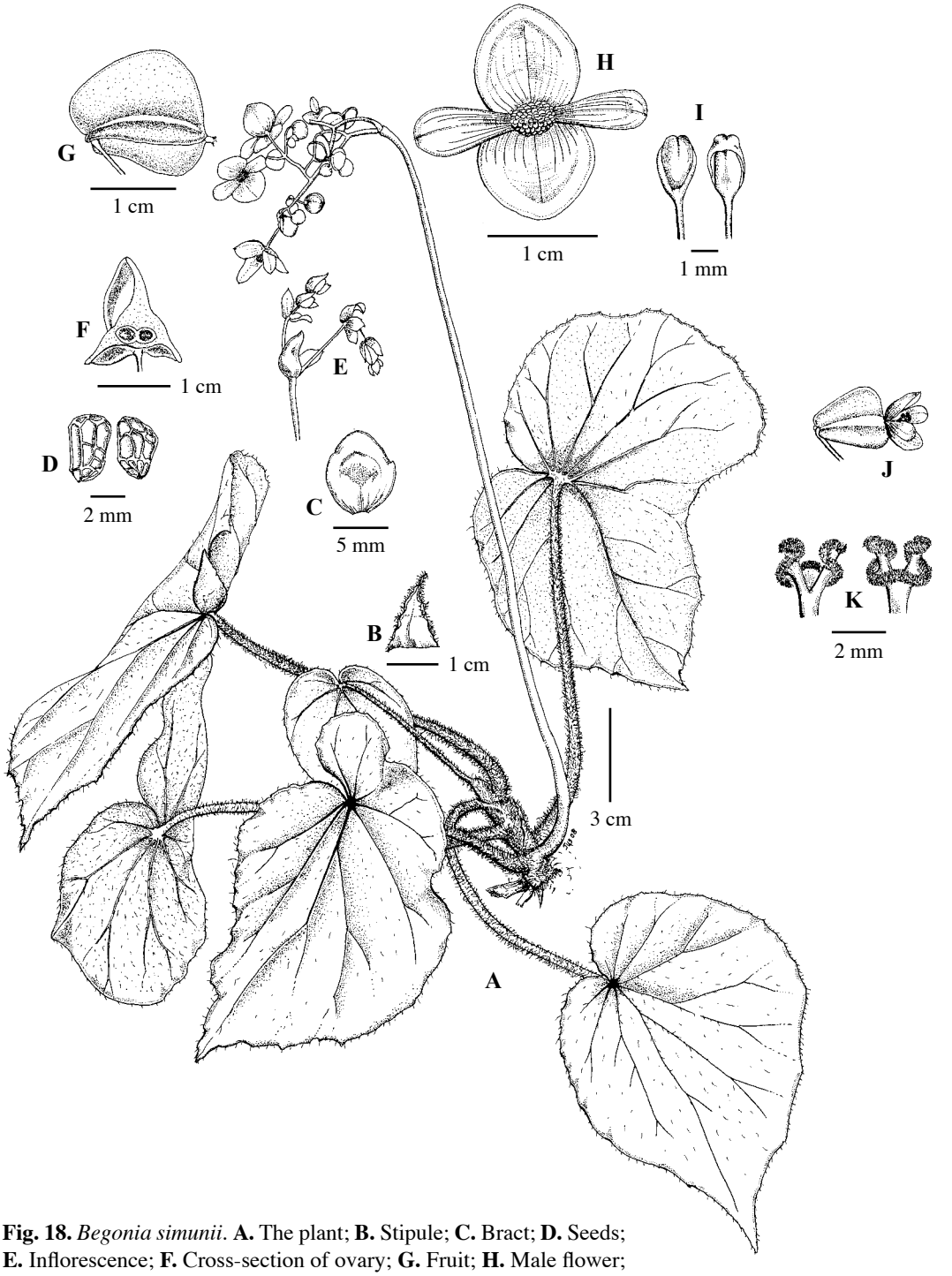


Fig. 18. *Begonia simunii*. **A.** The plant; **B.** Stipule; **C.** Bract; **D.** Seeds; **E.** Inflorescence; **F.** Cross-section of ovary; **G.** Fruit; **H.** Male flower; **I.** Stamens; **J.** Female flower. **K.** Styles and stigmas.

Rhizomotous, rosette begonia, rooting at the nodes. Stems brown-reddish, 6.5–9 cm long, *c*. 1.8 cm diameter with scattered hairs, succulent, internodes short *c*. 1 cm long. Stipules translucent, slightly hairy beneath, triangular, *c*. 11 × 17 mm, margin entire, apex acuminate, acumen *c*. 5 mm, persistent. Leaves upstanding or semi-erect, *c*. 1 cm distant, oblique; petiole reddish, 13–20 cm long, terete hairs brown; lamina dark green above, glabrous, pale green with brown hairs below, thinly fleshy in life, slightly matt, broadly ovate, asymmetric, 10.5–11.5 × 15–18 cm, broad side 8–9.2 cm wide, base slightly rounded, basal lobes to 3.5–3.8 cm long, margin entire, apex acute; main veins light green, glabrous above, scattered brown hairy underneath; venation palmate, 4–5 veins in the basal lobe, impressed above, prominent beneath. Inflorescences protandrous, axillary from the upper nodes, reddish brown, glabrous, erect, longer than petioles, cymose, 25–32 cm long, peduncle *c*. 20–25 cm long with 3 male flowers and 1 female flower. Bracts glabrous, transluscent, orbicular, *c*. 4 × 5 mm, margin entire, caducous. Male flowers: pedicel white tinged pink, *c*. 5 mm long; tepals 4, glabrous, white tinged pinkish, margin entire, outer 2 tepals orbicular, 13–14 × 12–13 mm, apex rounded, inner 2 tepals narrowly obovate, *c*. 4 × 10 mm, apex rounded; stamens 82, cluster globose, stalked, *c*. 2 mm; filaments yellow, *c*. 1.8 mm, long; anthers yellow, oblong, *c*. 1 × 0.25 mm, apex rounded. Female flowers: pedicel *c*. 5 mm long, reddish, glabrous; ovary greenish pink, deltoid, *c*. 3–4 × 6–12 mm long, pure white or pinkish, wings 3, unequal, splash cup shaped, locules 2, placentas 2 per locule; tepals 5, white or pinkish, slightly oval, margin entire, apex rounded, *c*. 6–8 × 5–7 mm; styles 3, 2–3 mm long, yellow, widely shallowly Y-shaped; stigma papillose forming a continuous twisted band. Capsules dangling, 16 × 14 mm, glabrous, locules 3, wings unequal, narrowed to the base, pointed distally, 2 shorter wings *c*. 12 × 4 mm wide, larger one 16 × 10 mm wide, thinly fibrous, dehiscing between locules and wing; pedicel 12–15 mm long. Seeds barrel-shaped, 0.3–0.4 × 0.15–0.2 mm, columnar cells more than half the length of seed.

ETYMOLOGY. Named after Mr Simun Limbawang, the collector and the coordinator of the Tawau Hills Lowland Botanical Garden.

ECOLOGY. Primary forest, growing on boulders near river bank, at 350 m elevation.

DISTRIBUTION. Borneo. Endemic to Sabah (Tawau Hills Park).

CONSERVATION STATUS. Least Concern. It is found in Tawau Hills Park, which is a totally protected area.

SPECIMENS EXAMINED—BORNEO. SABAH: Tawau District: Tawau Hills Park — Tawau Hills Botanical Garden (Lowland Garden), *Rimi R., SNP A 16605* (SNP); Tawau Hills Park — Balung River, *Kinahim S. & Handry M., SNP 25246* (holotype SNP!; isotype SAN!).

NOTES. It has a very long and erect peduncle with many male but fewer female flowers. This species belongs to section *Baryandra* in having rhizomatous stems, protrandrous inflorescences, and the ovary with two locules. Like *B. gueritziana* Gibbs (1914), its fruit has an enlarged wing.

13. Begonia tindan Rimi & Kinahim **sp. nov.** (Section *Petermannia*)

Similar to *B. berhamanii* Kiew (2001: 253) in habit and laminas that are almost symmetric, lanceolate, about 12–16 × 2.5–4 cm, with short petioles and pinnate venation, but it differs in the inflorescence stalks being longer than petiole (vs. shorter than the petiole as in *B. berhamanii*), the overlapping bracts are pale green or cream, 9–10 × 4–5 mm (vs. red and 12 × 3–4 mm as in *B. berhamanii*) and its long-stalked female flowers have pedicels 12–15 mm long (vs. 2–3 mm long). Type: *Rimi Repin et al. KNP 12491,* Borneo, Sabah, Tawau District, Tawau Hills Park, Mt. Lucia, near Waterfall at km 10.5, 23 April 2007 (holotype SNP!; isotype SAN!). (**Figs. 19 & 20**)

Erect begonia, becoming decumbent and rooting at lower nodes. Stems 30–45 cm tall, brownish, 2–4 mm thick, appressed fine hairs, unbranched, woody, internodes *c*. 1.5–7.0 cm long, slightly thickened at nodes. Stipules pale green, glabrous, lanceolate, 12–15 × 3–5 mm long, keeled, margin entire with fine hairs, apex acuminate, acumen 1.5–2 mm long, persistent. Leaves alternate, not oblique, distant, held horizontally to slightly pointing up; petiole brown-greenish, finely hairy, 0.3–0.5 cm long, terete; lamina plain green above, light green beneath, glabrous, slightly fleshy in life and papery when dry, glossy, lanceolate,

Fig. 19. *Begonia tindan*. **A.** Inflorecense; **B.** Close-up of male flower; **C.** Fruit. All photos by Rimi Repin.

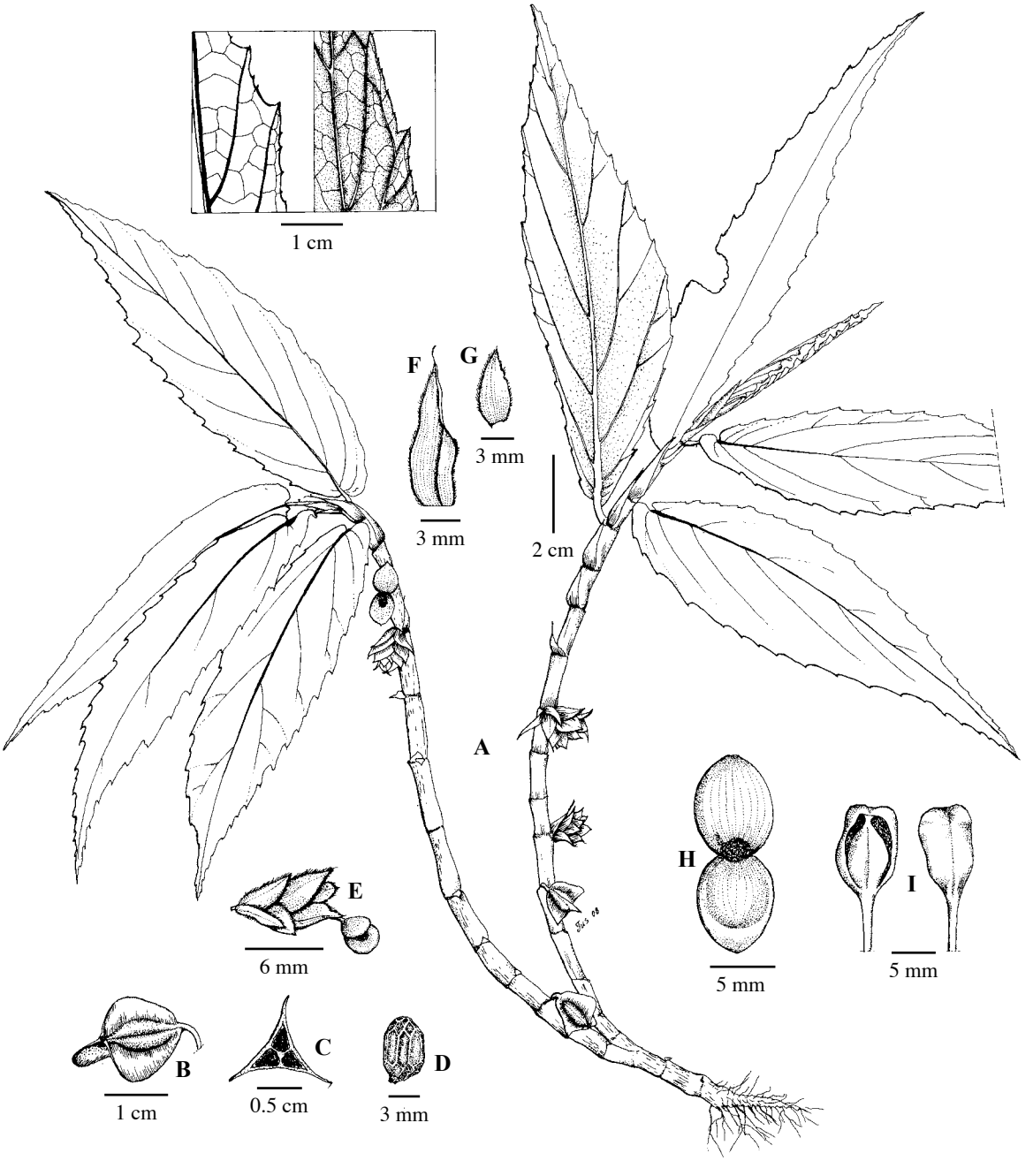


Fig. 20. *Begonia tindan*. **A.** The plant; **B.** Fruit; **C.** Cross-section of ovary; **D.** Seed; **E.** Inflorescence; **F.** Stipule; **G.** Bract; **H.** Male flower; **I.** Stamens.

asymmetric, 9.5–16.5 × 3–4.5 cm long, broad side 2–3 cm, base acuminate, margin distally serrate, apex acuminate, acumen 1.5–2 cm long; main veins green, glabrous above, hairy beneath; venation pinnate, 4–5 veins on either side of the midrib, branching towards the margin, impressed above, prominent beneath. Inflorescences protogynous, axillary; female inflorescences reduced cymes with one flower each on the lower stem; male inflorescences a flattened spike, 1–2 cm long, peduncle 0.2 cm long, brownish, fine hairs. Bracts overlapping, cream-white to pale green, broadly lanceolate, 9–10 × 4–5 mm, asymmetric, margin serrate, persistent. Bracteole pairs, translucent white, 4–6 × 1 mm, narrowly lanceolate; bracteole lanceolate, *c*. 3 × 7 mm, margin serrate. Male flowers: pedicel pure white, 4 mm long; tepals 2, pure white, glabrous, ovate, *c*. 8 × 4 mm, margin entire, apex rounded; stamens *c*. 23–24, cluster globose, *c*. 6 × 4 mm across (wider than long), sessile; filaments lemon yellow, *c*. 0.1 mm long; anthers lemon yellow, obovate, *c*. 1.5 × 1 mm, apex emarginate. Female flowers: pedicel 1.2–1.5 cm long, pure white; ovary green and white tinged pink when very young, *c*. 1–1.2 × 1.5 cm long, wings 3, equal, locules 3, placentas 2 per locule with many ovules on both surfaces; tepals 5, isomorphic, broadly lanceolate to ovate, 3 outer tepals *c*. 14 × 4 mm, 2 inner tepals *c*. 6 × 1 mm, white or white tinged pink, reddish hairy beneath, margin entire, apex rounded; styles 3, deep yellow, *c*. 3 mm long, divided to base, deeply Y-shaped with twisted tips; stigma yellow, papillose. Capsules pendent, *c*. 1.2–1.4 × 1.4–1.9 cm, shortly hairy in life, glabrous when dry, wings 3, equal, narrowed proximally, fibrous, dehiscing between the locule and wing, pedicel *c*. 0.4 cm long. Seeds barrel-shaped, *c*. 0.7–0.8 × 0.3–0.4 mm, columnar cells more than half the length of seed.

ETYMOLOGY. It takes name from its characteristic overlapping bracts. *Tindan* in Malay means overlapping.

ECOLOGY. Primary forest, under forest canopy, 100–800 m elevation.

DISTRIBUTION. Borneo. Endemic to Sabah (Tawau Hills Park).

CONSERVATION STATUS. Least Concern. It is found in Tawau Hills Park, which is a totally protected area.

SPECIMENS EXAMINED—BORNEO. SABAH: Tawau District: Tawau Hills Park — Marotai Kanan, waterfall, *Duni & Geofarry, KNP 14135* (SNP); Trail to Bukit Bombalai, *Masrina et al. SP 10519* (SNP, SAN), *Dolois et al. SP 18023* (SNP, SAN); Balung Hot springs area, *Dolois et al. SP 17420* (SNP), *Kinahim & Handry, SNP 25245* (SNP, SAN); Poreg River, Marotai kanan, *Dolois et al. SP 16782* (SNP), *Rimi R., SNP A 16608* (SNP, SAN); Lowland garden, *Simun & Enroe, KNP A 14716* (SNP); Mt. Lucia, near Waterfall at km 10.5, *Rimi Repin et al. KNP 12491* (holotype SNP!; isotype SAN!); Trail to Mt. Lucia, *Yabainus & Frederick, SP 11528* (SNP), *Yabainus & Duni, SP 11543* (SNP), *Shahidah & Siti Farhana, BORH 0568* (SNP, BORH); Trail near Headquarters, *Dato Noramly et al. BORH*

0654 (SNP, BORH); Balung Dipterocarp Plot, *Dolois et al. KNP A 14725* (SNP), *Dolois et al. KNP A 14726* (SNP); Near Gelas waterfall, *Dolois et al. KNP 13007* (SNP, SAN, KEP).

NOTES. It is distinct in having distichous, persistent bracts in the male flowers.

DISCUSSION

Prior to the present study, only one named species, *Begonia tawaensis* Merr., had been collected from Tawau District. However, its exact locality was not specified. The earlier report from the Tawau Hills Park Scientific Expedition in 1989, listed only two *Begonia* species identified as *B. beryllae* Ridl. and *B. burbidgei* Stapf (Latiff *et al*., 1995), but these are misidentifications. Beaman & Beaman (1995) also reported collecting two undetermined begonias.

This study recorded 13 *Begonia* species from Tawau Hills Park of which ten are new species described here, namely *B. basintaliana* Rimi, *B. gelasensis* Rimi, *B. gusilii* Rimi, *B. lamriana* Rimi, *B. mariaensis* Rimi & Simun, *B. jamiliana* Rimi, *B. paracauliflora* Rimi *et al*., *B. renek* Rimi, *B. simunii* Rimi and *B. tindan* Rimi & Kinahim. They are all narrow endemics restricted to Tawau Hills Park. The occurrence of the three other species, *B. gomantongensis* Kiew, *B. postarii* Kiew and *B. fuscisetosa* Sands, represent extensions to their previous known geographical distributions in Sabah. The first two are east coast species, previously known from the Kinabatangan River, but since collected from Lahad Datu and Tawau Distrcts, while *B. fuscisetosa* has a much wider distribution ranging from Sabah to Brunei Darussalam and Sarawak (Hughes & Pullan, 2007).

Almost all cane-like or erect begonias in Borneo belong to section *Petermannia* and the Tawau Hills begonias are no exception. Out of the 13 species, 12 species belong to section *Petermannia* and only one species, *B. simunii*, belongs to the section *Baryandra* (Rubite *et al.,* 2013).

This study also observed that species such as *B. jamiliana, B. gelasensis, B. basintaliana, B. tindan* and *B. lamriana* grow in the same habitat, either as single plants or in small populations scattered along the trail from Tawau Hills Park Headquarters towards Mt. Lucia and Mt. Magdalena. *Begonia basintaliana* and *B. gelasensis*, however, are mostly found along rivers and at lower elevations, up to 400–600 m. Even species with a wider distribution such as *B. postarii* share a similar lowland habitat with *B. renek* and are restricted to the Balung area on the east side of Tawau Hills Park. The most restricted distributions of any begonia in Tawau Hills are those of *B. mariensis*, known only from a single population on Mt. Maria peak (1067 m), *B. gusilii* found only on a waterfall boulder along the trail to Mt. Lucia (1189 m) at Km 10, and *B. simunii* that also has a restricted distribution and is known from only one small population.

Most of the Tawau Hills Park begonias are planted *ex situ* in the Tawau Hills Botanical Garden for research purposes and for recreational and environmental education programs, as well as to serve as a gene bank. To date, all 13 species can be seen growing either in the Garden or in the nursery. *Begonia lamriana* and *B. simunii* have the greatest potential as ornamental pot plants. They grow very well within a short period of time but need frequent care by repotting to make sure they regenerate continuously. All the cane-like begonias grow well in the Garden and some are used as ornamental plants around the office compound.

CONCLUSION

The large number of *Begonia* species, encompassed in only a small part of Tawau Hills Park, is an indication of high diversity and the fact that the majority are new species shows how little is known about the ecology and distribution of *Begonia* in Sabah. Thus, this study contributes baseline data for further research related to begonias in the future.

ACKNOWLEDGMENTS

We should like to thank the Director of Sabah Parks, Dr Jamili Nais for the continuous support in this study. We also thank all the Sabah Parks Management for their strong support in finance, logistics and facilities. We are grateful to both former Directors of Sabah Parks, Datuk Lamri Ali and Mr Paul Basintal for their kind advice, not forgetting Park Warden Mr Ariffin Johari and the former Park Warden Mr Jufri Nasrin. Thanks, too, to all the botany staff and former staff, Matsain, Dolois, Geofarry, Rossiti, Handry, Sukaibin, Rahimah, Masrina, Zainuddin, Anthonio, Masius, Hadimin etc., for their kind and cheerful help in the field. Thanks to Associate Prof. Dr Monica Suleiman and Dr Liew Thor Seng of Universiti Malaysia Sabah for their collaboration in the phylogenetic work which is yet to be published. Thanks to Jusimin for the excellent botanical drawings, to Ramlan, Enroe and Yabainus for providing the photos, and to Azami Bongsu for arranging the plates. Finally, our thanks to Dr Ruth Kiew for advice on the manuscript.

REFERENCES

Beaman, J.H. & Beaman, R.S. (1995). Additions to the Checklist of Flowering Plants of Tawau Hills Park, Sabah. In: Ismail, G., Omar, S. & Din, L.B. (eds.). *A Scientific Jorney through Borneo — Tawau Hills Park*. Pelanduk Publications, Petaling Jaya. Pp. 85–94.

Chong, F.Y., Guanih, V.S., Julia, S. & Kiew, R. (2015). *Begonia* (Begoniaceae) in the Danum Valley Conservation Area, Sabah, Borneo, including Eleven New Species. *Sandakania* 20: 51–85.

Gibbs, L.S. (1914). A Contribution to the Flora and Plant Formations of Mount Kinabalu and the Highlands of British North Borneo. *Journal of the Linnean Society of London, Botany* 42: 1–240.

Gobilik, J. & Limbawang, S. (2010). Notes on species composition and ornamental gingers in Tawau Hills Park, Sabah. *Journal of Tropical Biology and Conservation* 7: 31–48.

Hughes, M. & Pullan, M. (2007). Southeast Asian *Begonia* Database. Electronic publication accessible via www.rbge.org.uk.

IUCN (2001). *IUCN Red List Category and Criteria. Version 3.1*. IUCN Species Survival Commission. Gland, Switzerland and Cambridge, U.K.

Julia, S. & Kiew. R. (2014). Diversity of *Begonia* in Borneo — how many species are there? *Reinwardtia* 14(1): 233–236.

Kiew, R. (1998). Niche partitioning in limestone begonias in Sabah, Borneo, including two new species. *Gardens' Bulletin Singapore* 50: 161–169.

Kiew, R. (2001). The limestone Begonias of Sabah, Borneo — Flagship species for conservation. *Gardens' Bulletin Singapore* 53: 241–286.

Latiff, A., Sukup, A., Awang, Z., Salleh, H. & Ibrahim, A.Z. (1995). Notes on the flowering plants of Tawau Hills Park, Sabah. In: Ismail, G., Omar, S. & Din, L.B. (eds.). *A Scientific Journey through Borneo — Tawau Hills Park*. Pelanduk Publications, Petaling Jaya. Pp. 65–84.

Lim, W.H. (1995). A preliminary survey of Orchids in Tawau Hills Park, Sabah. In: Ismail, G., Omar, S. & Din, L.B. (eds.). *A Scientific Jorney through Borneo — Tawau Hills Park*. Pelanduk Publications, Petaling Jaya. Pp. 107–126.

Rimi, R., Dolois, S. & Handry, M. (2008). Laporan Kerja lapangan, Taman Bukit Tawau: Plot Penyelidikan Kekal Taman Bukit Tawau (Siri II). Unpublished Report.

Rimi, R. & Yabainus Johalin (2008). Laporan kerja lapangan, Taman Bukit Tawau: Dokumentasi Araceae. Unpublished Report.

Rubite, R.R., Hughes, M., Alejandro, G.J.D. & Peng, C.-I. (2013). Recircumscription of *Begonia* section *Baryandra* (Begoniaceae): evidence from molecular data. *Botanical Studies* 54: 38.

Sands, M.J.S. (1990). Six new begonias from Sabah. *Kew Magazine* 7: 57–85.

Sands, M.J.S. (1997). Begoniaceae. In: Coode, M.J.E., Dransfield, J., Forman, L.L., Kirkup, D.W. & Idris, M.S. (eds.). *A Checklist of the Flowering Plants and Gymnosperms of Brunei Darulsalam*. Brunei Forest Department and The Royal Botanic Gardens, Kew. Pp. 432–434.

Seino, T., Kanehiro, K. & Lakim, M. (2007). Floristic composition and stand structure of mixed Dipterocarp Forest in Tawau Hills Park, Sabah , Malaysia. *Sabah Parks Nature Journal* 8: 63–82.

Stapf, O. (1894). On the Flora of Kinabalu: Begoniaceae. *Transaction of Linnean Society of London, Botany,* Ser. II(4): 164–167.